OCTOBER, 1906.

AMERICAN QUARTERLY OF ROENTGENOLOGY

PUBLISHED BY THE AMERICAN ROENTGEN RAY SOCIETY

Volume I. No. 1

Next Annual Meeting Cincinnati September 25th, 26th and 27th, 1907

CONTENTS

American Quarterly of Roentgenology.

Published by The American Roentgen Ray Society.

American Quarterly of Roentgenology.

Published by the American Roentgen Ray Society.

Business Office, 611 Fulton Building, Pittsburg, Pa.

EDITORIAL DEPARTMENT.

The Publication Committee, after due deliberation, thought it best for the furtherance of all interests of the American Roentgen-Ray Society to publish a quarterly in place of the annual transactions. This Journal is the property of the Society and the Committee on Publication welcome suggestions and communications, all of which will be given proper consideration.

Roentgenology is a department of medical science that has grown to such an extent that its followers are entitled to a certain respect for their work and for their conclusions. This respect is not always accorded. The reasons for this are not hard to find. Many of the workers in this field have been content to be classed as photographers and picture makers, allowing their plates to pass through other hands and to be interpreted by others. They have been careless in the choice of terms to be employed. They have allowed the term "Roentgenogram" or "diagnostic plate" to be supplanted by the terms "photograph," "picture," etc. This carelessness on their own part cannot but lead to a similar carelessness on the part of those with whom they come in contact. It is time that the experts in the science of Roentgenology demand for their work the recognition which is due them. To receive this respect it is necessary for the Roentgenologist to preserve a proper dignity in referring to his diagnostic work. He should be careful in his nomenclature, preferring such terms as Roentgenogram, diagnostic plate, etc. He should in general let the profession and laity understand that the fee for his services is based upon the diagnostic conclusions which he reaches. He should maintain in his own hands his Roentgenogram, delivering simply the diagnosis. He should avoid arguing

with the laity concerning interpretations of his records of density. In other words, he should maintain always the position of consultant, who gives diagnostic conclusions based upon special lines of investigation. In regard to treatment, he should not allow himself to be dictated to either as to the number or character of his treatments by the attending physician. He should give the profession and the patient to understand that all the details of Roentgen therapeutics are guided by his judgment and experience.

It would seem that if Roentgenologists would adopt an attitude and position such as above outlined, they would receive the respect which is their proper due.

3l 31

AMERICAN
Quarterly of Roentgenology

Volume I OCTOBER, 1906 Number 1

THE TEACHING OF ROENTGENOLOGY IN MEDICAL COLLEGES.

By VERNON J. WILLEY, A. M., Instructor in Electro-Therapeutics and Director of the Roentgen Laboratory, University of Michigan.

The value of the Roentgen rays as a diagnostic and therapeutic agent needs neither defense nor demonstration before this society. Every Roentgenologist has seen sufficient evidence to convince him of the utility of Roentgen diagnosis and Roentgen therapy. Yet it is undoubtedly true that the mistakes, failures and injuries incident to the experimental stage of the work, as well as the lack of knowledge of the effect of the rays at that time, have done much to discredit Roentgenology among many members of the medical profession.

The increased knowledge of the action of the rays, physical, chemical, physiological and pathological, have been of such a nature in recent years that we can now say truthfully that almost in direct proportion as is the knowledge of the subject exact, and the technique correct, may the utility of the Roentgen rays be demonstrated.

As a science, however, Roentgenology is still in its infancy. We have still a great deal to learn. Careful study, comprehensive research, intelligent interpretation and more exact methods of work will bring broader application and increased utility. At present we have reason to hope that our knowledge of the effects of the rays upon the living animal cell is sufficiently extensive so that most of the dangers may be altogether avoided.

Since Roentgenology has come to have a recognized place in diagnosis and therapeutics, and since satisfactory results are obtained only through intelligent use and correct technique, it is of importance that the physician should be well informed on the scope and limitations of the subject. Especially is this true since the physician of the future, no matter how he may wish to avoid it, will find himself under the necessity of using the rays either for diagnosis or treatment, not once, but many times during the course of his professional career.

Whether or not he chooses to do his own Roentgen work, or to refer it to a Roentgenologist, a knowledge of the application of Roentgenology to clinical work will be a necessity. The medical college of the present day must, therefore, give some attention to teaching the use of the Roentgen rays. I believe it is important in this connection to confine the instruction to the principles of the subject, as far as we know them, and to avoid the exploitation of pet theories. It will not be possible to make Roentgen experts, nor will it be possible to enable each student to become proficient in technique. The skill he must acquire for himself, but let there be a knowledge of principles preceding it.

What the medical student should know first of all is what can be done by the use of the Roentgen rays in therapeutics and diagnosis. He should also be given sufficient instruction to enable him to select such apparatus as will meet the needs of the Roentgenologist, and to know that he must devote himself to a thorough understanding of the apparatus and the conditions under which he labors, so that he may develop a correct technique. In order that he may have a clear idea of the principles of Roentgenology, the student must possess a general knowledge of radio-physics and of the physical principles of the apparatus employed. Demonstrations of apparatus, under the different conditions which must be met, and of the methods of controlling and regulating the apparatus, should be given in connection with a discussion of the physics of the subject.

Given medical students of the present day where en-

trance requirements include a general knowledge of physics, this instruction is comparatively easily and rapidly imparted.

Of much greater importance, however, is instruction in the practical uses of the rays. In diagnosis the student should be taught how to make a fluoroscopic examination under conditions necessary for his own safety and the safety of the patient. The importance of shielding, of diaphragming, and of making the examination within a proper time limit should be emphasized. He should also be taught how to interpret, in a general way, what he sees upon the screen, that it is not a picture, but that it is a record of the densities traversed by the rays, in passing through the structure under observation. He should be taught the purpose and the value of a fluoroscopic examination, the liability to error and the absolute insufficiency of relying upon it alone as a diagnostic instrument, especially where detailed information, such as can be given only by the radiograph, is necessary.

The advantage of the fluoroscope in studying motion, and in giving a general idea of relationships, can not be denied. Yet one should have a clear idea of the limited use, and of the extended danger, in a too free use of the fluoroscope.

In radiography the student should be taught to recognize a radiograph which is reliable for diagnostic purposes, and of the necessity for more than one radiograph of the pathological condition. Radiographs made at different angles or stereoscopically, both of the pathological condition, and of the corresponding normal anatomy of the patient, wherever possible, should be presented for interpretation. It is especially desirable that the student should understand the value of correct interpretation, not only for the purpose of treating the condition more skillfully, but he should realize the importance of this in medico-legal cases where radiographs are submitted as evidence. He should also understand the conditions under which distortion is produced and never allow a radiograph showing an

apparent deformity to prejudice his mind against a case where good functional results were obtained.

The careful study of a series of radiographs, of both normal and pathological conditions, with especial reference to interpretation, is of the greatest value in a course in Roentgenology, because it combines both practical and educational value in a high degree. The real value of Roentgen diagnosis can be better demonstrated in this than in any other way.

If a majority of the plates studied are those of patients seen in the clinics, so that the diagnosis and methods of treatment are fresh in the mind of the student, so much the better. If some of the radiographs are made in the presence of the section in Roentgenology, and the detailed methods of radiographic procedure are demonstrated, and these radiographs studied, and the patient be kept under observation, it will be of still greater value. The careful and extended study of a limited number of well selected cases will prove of greater value than a superficial study of a great many.

In Roentgen therapy the student should be instructed in the effects of the rays upon the various tissues, so far as is known, and to what extent pathological conditions yield to irradiation. The application and limitations of the Roentgen rays in therapeutics should be carefully presented. Demonstrations of the method of treating different conditions should be given, and the reason for the technique presented. Methods of measurement both of current strength used to excite the tube, and the penetration of the rays as measured by the Benoist and Walter instruments should be demonstrated. The quantitative measurements of the rays, inaccurate and unsatisfactory though they may be, should be presented, and the necessity for more accurate methods of dosage than a time unit should be brought to the student's attention.

Patients receiving treatment should be under observation by the members of the class for as long a period of time as circumstances will permit. In demonstrating the methods of treatment in a Roentgen ray clinic it is also of

fundamental importance that the diagnosis should be accurately determined, and a microscopic examination be made in every case possible.

The time which may be given to the subject will necessarily vary with the conditions which confront the Roentgenologist. A very satisfactory way of presenting the subject is to have the senior class divided into small sections, and the work given by lectures and demonstrations for one hour or two hours per week, for either a semester or half a semester. From twelve to twenty hours would be required to present the essentials of the subject, without giving it any more attention than its importance demands.

Through correspondence with the Deans of most of the American medical colleges, I find that at present some attention is given to teaching this subject in nearly every one. The hospitals of even the smaller colleges are, as a rule, equipped with Roentgen apparatus for both diagnosis and therapy. In many of the colleges the instruction is comprehensive, systematic and connectedly presented. I believe it is unfortunate to have the instruction presented intermittently, by different clinical men, at only such time as the fancy presents itself. It is, of course, important that the teaching be correlated with the clinical instruction as far as possible, but it is a saving of time, and is of greater value to the student, if the instruction be presented by a competent Roentgenologist.

The success of the instruction depends to no little extent upon both the mental equipment of the instructor and the equipment of his laboratory. He should be practical, and be possessed of both a knowledge of the fundamental physics and of the medical sciences. He should be familiar with the literature of the subject. He should keep in touch with the work of the different clinics, and with the work of other Roentgenologists. A careful record should be kept in the laboratory of all work done, the results obtained, the microscopic examinations made, and all physical measurements obtainable. It is only by careful, systematic work and record keeping that we may hope to place Roentgenology on a strictly scientific basis.

But it is not the medical student alone who needs instruction in the applications of the Roentgen rays. There are many physicians whose doubts might be removed and who would make use of the rays were they convinced that such use would lead to better results in their practice. But they are not to be convinced by flattering reports in medical journals alone. It is the duty and it should be the pleasure of every Roentgenologist to present to his medical society such cases and such demonstrations as will lead to a just and true appreciation of the work of the agency.

Though he be an enthusiast, the Roentgenologist should scrupulously avoid making hasty conclusions, extravagant claims or of making a positive diagnosis from his plates except when absolutely justified in doing so. It is better to err on the side of conservatism than to shake the faith of his colleagues by premature conclusions. There should be a united effort on the part of Roentgenologists to give to the medical profession an accurate knowledge of the use of the Roentgen rays, and to keep the work within the boundaries of its legitimate field.

Discussion on Dr. Willey's Paper.

Dr. Charles Lester Leonard, Philadelphia—This subject is of the utmost importance to the progress of Roentgenology. It is essential that the medical student be taught what the X-ray may be worth to him in diagnosis and in therapeutics. This can only be done, however, in cities where there are men competent to do the teaching, men who know the work and the value of the X-ray in medicine, both as a diagnostic and a therapeutic agent. When we meet annually, and by contributing to the literature of the day, we teach the general profession, we do all we can to advance this work, but it is essential that some didactic teaching be offered the medical student before he leaves college.

We have all had the experience of seeing a group of physicians standing around a high frequency machine, with mouths wide open, watching a spark come out of the res-

onator as though it were something supernatural. That impression must be eradicated from the mind of the profession before we can expect to get a proper consideration of the worth of the X-ray. The only way to do that is to get at the profession through the medical student. We must teach these men how to protect themselves, and how to protect their patients, and to do work that is worthy of the wonderful energy we are using before we can gain the desired end. It is a distinct step in advance when we can get men like Dr. Willey to come here and read such a scholarly paper. The more we can push this matter, the better it will be for the science of Roentgenology and for the medical profession as a whole. It is necessary that we should know what is being done in medical colleges throughout the country in this field of work.

Dr. Kennon Dunham, Cincinnati, Ohio—I would like to say for my own college, the Medical College of Ohio, that last year they created a lectureship on Roentgenology. The laboratory is equipped with an X-ray outfit and as many kinds of coils as we can get, so that the student may be able to learn how to handle the various currents, no matter what coil or current he is given. The patients are referred from the general medical clinic. The method of teaching is one lecture a week, and one hour a week for the clinical demonstration. On two other days in the week the material is accumulated, so that the class may have the benefit of all the patients treated throughout the week.

There is nothing original about this method, and it is very nearly Dr. Willey's plan. I hope that more colleges will adopt systematic teaching of this subject. The members of this society should take the stand that the medical colleges must include this subject in their curricula; they must do it, first, for their own good, and secondly, for the benefit of their students.

Dr. S. M. McCollin. Philadelphia—This is one of the most important things that can be brought before this society. Twenty-eight years ago I began teaching pharmacy

in the Jefferson Medical College. There was just as much opposition at that time to the teaching of pharmacy as there is today to the teaching of Roentgenology. I hope that our colleges will take up this matter because it is a very important part of our therapeutics today. It should be taught by those who understand the subject thoroughly, just as hydrotherapy, etc., are taught.

Dr. Willey has outlined the plan of teaching so well and so thoroughly that I can not add anything more.

Dr. Preston M. Hickey, Detroit, Mich.—In a conversation I had with Dr. Willey some time ago on this subject, he outlined some of the details of his method of teaching Roentgenology in the University of Michigan. I favor the use of the lantern very much in teaching students the application of the Roentgen ray, preparing lantern slides of as many negatives as possible, throwing them on the screen and giving the clinical history of the case, and then bringing out particularly the points that can be demonstrated from the lantern slides in the way of assisting in the diagnosis, and the limitations of the radiograph. In that way the student becomes familiar with a large number of positives and he gets a good general idea of the scope and application of the X-ray in diagnosis.

Dr. A. Clifford Mercur, Syracuse, N. Y.—In the College of Medicine of Syracuse University the lantern slide method is carried a little farther; and with seemingly good advantage. We have a very clever man with us who has produced a large series of slides representing the diagrammatic pictures shown in text books. These seem to be very helpful in the theoretical explanation of apparatus. Of course, lantern slides from radiographic negatives are also used.

It is quite interesting to see how much ground can be covered in an hour with a series of pictures of various apparatus. For instance, you may show one or two types of apparatus in use in the college, and with the lantern supplement this demonstration by showing a dozen or more

types of apparatus, giving the student a comprehensive grasp of the various types of apparatus in use.

Dr. Lang, Cincinnati, Ohio—As a further argument in favor of the value of teaching this subject in medical colleges, let me call your attention to the fact that de la Camp, of Berlin, has seen fit to resign his position as first assistant to Krause to accept a professorship of Roentgenology as used in the diagnosis of diseases of the heart and lungs.

Dr. Henry Hulst, Grand Rapids, Mich.—I have had the pleasure of visiting Dr. Willey in his laboratory, and of meeting some of his classes, and I was very favorably impressed with the work he is doing. I have also seen Dr. Hickey working in his laboratory with his classes, and I can tell you that he is an expert with the lantern, as well as with the vacuum tube.

One might gain the impression from Dr. Willey's paper that he attempts to teach only the principles of Roentgenology, but he does more. He does post-graduate as well as undergraduate work. He gives his students an opportunity to learn the principles, and also how to apply them in practical work.

Dr. Lawrence, Memphis, Tenn.—I, too, have been interested in knowing to what extent medical colleges teach this work. Last year I persuaded my college faculty to spend several hundred dollars to equip an X-ray laboratory. My plan has been to give this course to the students of the graduating class, dividing the class into three sections, devoting one month to each section, giving two hours three times a week. This is a little more than has been mentioned here today. A new medical college has been organized in Memphis and Dr. Marcus Haas has been put in charge of the Roentgen ray work. He has been sent over to Germany to get posted on the latest innovations in Roentgenology. This will give you an idea of what we are doing in the South.

Dr. Vernon J. Willey, closing the discussion—I am sure that I appreciate the discussion on my paper very much. The way the course is given in the University of Michigan is practically as I outlined it in my paper. The instruction is all given in the laboratory. In the course in physics the instruction is imparted by demonstrating the apparatus at the time the work is being done. I have aimed to make the course as practical as possible, at the same time teaching the underlying principles and their application.

I have only recently adopted the method of having students study negatives with special reference to interpretation. I have never used any lantern slides, partly because we have not time, and partly because we have so many negatives at our disposal. I call for a whole series of plates at any time; for instance, pleurisy with effusion, or tuberculosis of the lungs and bones, or any other affection. The aim I have in showing these plates is largely to enable the student to judge whether the plate would be considered as sufficiently accurate in technique for diagnosis, so that when they come to examine plates for themselves, either their own or those of other Roentgenologists, they will be in a position to judge quite accurately the diagnostic value of the plate. I have done that because I have felt the necessity of it; the lack of knowledge of interpretation is so evident.

THE ACCUMULATIVE EXPERIENCE OF THE PROFESSION IN THE USE OF ROENTGEN RAYS IN THE TREATMENT OF ACNE, ACNE ROSACEA, ECZEMA AND PSORIASIS.

By ANDREW P. BIDDLE, M. D., Detroit, Mich., Member of the Council of the American Dermatological Association, the American Roentgen Society, Consulting Dermatologist to the Detroit Board of Health, Etc.

The true test of the value of a therapeutic agent must ultimately rest in the practical use to which it can be and is put by the clinician. While the wonderful advances made in the art of radiography is acknowledged by the profession and the laity alike, the same recognition is not accorded to radiotherapy either by the profession or the laity.

On July 12th, I accepted, therefore, the courteous invitation of the Executive Committee of the American Roentgen Ray Society to ascertain for this body the experience of the profession in the use of Roentgen rays in the treatment of acne, acne rosacea, eczema and psoriasis, four of the more common affections met with in a dermatological practice. It was suggested that a sufficient trial had been given to this line of treatment, nearly a decade, for us to have determined the practical value of the rays as a therapeutic agent and that I might as a member of the American Dermatological Association voice the accepted views of the association in the use of the Roentgen rays in the treatment of these common diseases of the skin.

That I might not misinterpret the views of the profession and might have at hand some definite knowledge upon which to draw conclusions, I drafted not only to the active and honorary members of the American Dermatological Association, but to many other members of the

Read by invitation before the 7th Annual meeting of the American Roentgen Ray Society at Niagara Falls, N. Y., August, 29 to 31, 1906.

Section on Cutaneous Medicine and Surgery of the American Medical Association, to recognized dermatologists of Ontario, Great Britain, Germany and France, and to members of this body the following communication:

Detroit, July 19, 1906.

"I have been requested by the Executive Committee of the American Roentgen Ray Society to present a paper at the meeting next month outlining our experience with the use of Roentgen rays in the treatment of acne, acne rosacea, eczema and psoriasis.

"I would appreciate it very much if you would grant me the benefit of your experience and views, with permission to publish, by answering in substance the following questions:

1. (a) Has the use of Roentgen rays been found beneficial in the treatment of acne, acne rosacea, eczema and psoriasis?

(b) If so, in which stage or type of the respective diseases have the exposures to the rays been found useful?

(c) When contraindicated or harmful; and when of doubtful value?

2. (a) Are the exposures preferred as the routine treatment or are they applied to the rebellious cases only?

(b) Is the duration of treatment shortened?

(c) Are more permanent results secured?

3. (a) Has the use of the rays been as helpful as anticipated or have they proven more or less of a disappointment in the treatment of these diseases?

(b) Wherein lies, in your opinion, the cause of failure.

4. Any other information which will aid me to record definite knowledge of actual experience in the treatment of these diseases."

As so much of the success in the use of therapeutic agent depends upon the general knowledge, experience,

dexterity and personality of the operator and his knowledge and attention to details, it would have been more satisfactory and interesting and we would have arrived at more practical conclusions had we been able to draw from him his knowledge and technique; but, as it would have been impossible to judge from his writings the technique and personal equation of the operator and their relative value, it is assumed that each employs in his work such methods as have in his experience seemed best. Therefore, no question is raised as to the make and character of the tube, whether of high or low vacuum, whether attached to the coil or to the static machine; or as to dosage or to distance or to duration or frequency of exposure and other minutiae. It is assumed also that we all are familiar with these common diseases. We all know the conditions which predispose to acne, to acne rosacea, to eczema and to psoriasis; the pathology and the tried routine treatments for each are familiar to us. No one of us would deny to proper diet, to exercise their influence upon acne; nor its relation to gastro-intestinal and utero-ovarian troubles. No one of us would deny that the condition of an acne rosacea is aggravated by the use of hot drinks, tobacco, alcohol, improper food and feeding. No one would question the wide field of cause and effect of an eczema, its interdependence upon other constitutional diseases and upon external influences. Those of us who are essentially clinicians recognize that there is a type of psoriasis which so closely resembles eczema seborrhoicum as to be with difficulty differentiated. (Norman Walker doubts if the line of differentiation can be drawn). The lesions of this type of psoriasis, presenting a greasy, slightly scaly, inflammatory appearance, we all know are the more amenable to the ordinary means of treatment. The question simply is, knowing all these things, have we found by actual experience the use of Roentgen rays of value in the local treatment of these diseases; have the rays supplanted entirely other forms of treatment? If of value, how does this form of treatment compare in efficiency with other tried measures?

I believe the time has arrived when the profession at large would have this society place an estimate on the use of the Roentgen rays as a therapeutic agent and to this task, insofar as the their use relates to the four diseases selected for me, I have applied myself.

At the 29th annual meeting of the American Dermatological Association held in New York City, December 28 to 30, 1905, Dr. Henry W. Stelwagon of Philadelphia read by invitation a paper entitled "Additional Observations on the Use of Roentgen Rays in Dermatology," and in the extended discussions which followed most of the members present expressed views.

The conclusions set forth are drawn from the replies received from my communication, from Dr. Stelwagon's recent article (The Journal of Cutaneous Diseases, March, 1906), from the views expressed by members present at the reading of this article, from writings of other members of the profession and from my own clinical experience and observations; but, in order that each may draw his own, the premises upon which the conclusions are drawn are attached below, the italics being mine.

The answers are probably as uniform as to experience as one would expect from so extensive a field of observation and of variety of interests, the only serious difference of opinion being the estimate to be placed upon the rays in the treatment of acne. As one would expect, those who lean more towards radio-therapy claim greater reward by reason of their more intimate knowledge of X-ray therapy, better technique and personal application to details, and adhere to this method either for want of a familiarity with others or because most frequently all other means have been exhausted before the patient has been referred or has on his own initiation applied to him for relief. His cases are selected for him; the radiotherapist is expected to try radiotherapy. Those who are more inclined to dermatology lean by reason of their experience with other remedies to other methods, and many dermatologists, notably Prince A. Morrow, H. H. Whitehouse, Arthur

Hall (Sheffield), J. C. Johnston, have not been sufficiently impressed with what they have seen of other men's work to adopt the use of Roentgen rays as a therapeutic measure; and others after an experience have discarded their use in the treatment of these diseases notably Gottheil, whose views are so antagonistic to X-ray therapy as to invite attention. He says that in his judgment it is entirely improper to ray acne, rosacea, eczema or psoriasis.

Leslie Roberts (Liverpool) writes:

" In reply to your questions relating to the X-ray treatment, I may say that I consider the treatment of acne, rosacea, eczema and psoriasis by X-rays to be irrational, improper and utterly inadmissable on scientific grounds. I am afraid that those who talk of 'curing' these diseases by rays do not clearly understand the nature of the diseases."

Of the four diseases the greatest difference of opinion exists as to the estimate to be placed upon the value of Roentgen rays in the treatment of acne. Though many, including Hyde & Montgomery, Neumann, T. Colcott Fox, H. G. Brooke, Leredde, John McMaster, (Toronto), Breakey, R. R. Campbell, Arthur Whitfield, Rudis-Jicinsky, H. C. Baum, Geo. M. Mackie, Rollins H. Stevens, Stelwagon, Lustgarten, Bronson, Gilchrist, Engman, G. W. Wende, Hutchins (Atlanta), give testimony to the efficacy of the rays, only Pusey D. W. Montgomery, Grindon, Howard Morrow, Varney, Burnside Foster of the dermatologists acknowledge their use in daily routine treatment. Varney reports a series of 50 cases treated. Charles Lester Leonard would apply radiotherapy to obstinate conditions of acne, giving credit for success to his knowledge of the efficiency and limitation of his agency and to his technique. Kassabian uses the rays as a routine treatment in all cases in connection with hygienic and systemic treatment; but Hyde and Montgomery, Hartzell, Winfield, Darier, D. King Smith and most observers would confine their use to the chronic, rebellious, deep seated, sluggish indurated staphylococcic pustular type. Bulkley, J. C. and C. J. White, Bowen,

Corlett, Ravogli and others deprecate their use except in very obstinate cases and the New York Skin and Cancer Hospital (see abstract from Dr. Fred Wise's article) and Gottheil have discarded the use of the rays in the treatment of this disease, as being inappropriate for radiotherapy. Max Joseph has seen no lasting results follow.

Quoting from the report of C. J. White.—"Theoretically X-rays should benefit acne, through their inhibitory effect on highly differentiated structures. The amount of X-ray exposure necessary to depress glandular activity seems to be a very variable factor, if one is at the same time to keep within the limits of safety; and probably with safe exposures much more time is necessary than we would desire."

The late Dr. Charles W. Allen took exception to Dr. Stelwagon's statement that "the best and quickest results are, as a rule, only obtained after the production of a mild erythema,' but W. G. Brooke, Gilchrist and others agree with Stelwagon that the production of a transitory redness seems necessary. Allen believed that the rays should be expended on the deep follicles and glands, and most of us are agreed that the exposures should be mild and of short duration.

ACNE ROSACEA.

It is generally conceded by those who report benefit that the greatest good is achieved in those cases in which the sebaceous glandular inflammation predominates; that but little effect is made upon the dilated vessels and none upon the tumefaction of the nose. But few, however, report much progress and my own experience has been very disappointing. An exception to this, however, is found in the favorable reports of H. G. Brooke, Rudis-Jicinsky, James Galloway (London), the Whites and Bowen of Boston.

ECZEMA.

Though the field of cutaneous maladies covered by the term eczema is very broad, I think we will agree that to no other stage or type of the disease than the chronic,

localized, indurated patch, found as a type on the palms of the hands or on the soles of the feet, conditions which have resisted all other forms of treatment, is radiotherapy applicable. Some would apply the therapy to the sub-acute stage; all would exclude its use in the acute, (except in exceptional cases for the relief of a severe prueritus). in the eczemas of childhood, (except in obstinately chronic cases), and in an eczema "otherwise easily managed." "The action of the X-rays on eczema we have accustomed ourselves to explain by the selective action on the cells composing the infiltration of the corium, and by their stimulating effect on the process of cornification, thereby causing more active exfoliation of the corneum." (C. J. White).

PSORIASIS.

Though Pusey uses the rays in the routine treatment of psoriasis and D. W. Montgomery in his routine treat- of psoriasis of the nail and though the latter advises their use in the acute exacerbations, most observers would limit radiotherapy to the persistent large infiltrated plaque or aggregated smaller lesions, which nothing else seems to affect with any degree of permanency. But three observers (C. J. White, James Galloway and Rollin H. Stevens) admit it to be of any value in cases of extensive distribution. With some, as Prof. Dr. Heisser, the lesions have responded promptly to treatment, but with others all attempts have ended in failure. (See Duhring's and Gotthiel's remarks). Recurrence seems to be as frequent as with other methods of treatment.

J. C. White, Bowen, Charles J. White and Burns report approximately forty cases treated during the last five years, a very large majority of which have reacted favorably. "Increased metabolism in the rete mucosum and stimulation of the process of cornification would seem to account for the favorable action of the X-rays in psoriasis" in their opinion.

CONCLUSIONS.

I feel justified in presenting the following conclusions, which I trust will be ratified or modified to meet the views of the members, that the result may be an authoritative expression of this society:

Time, a decade, through the experience of a large number of competent observers has given to Roentgen rays a valuable and by reason of improved methods for the measure of dosage and perfection of machinery and technique, an ever increasing usefulness as a therapeutic agent in the local treatment of acne, acne rosacea, eczema and psoriasis. Conservatively used, with due regard to their well recognized dangers, especially in these non-malignant dermatoses, a knowledge of their efficiency and limitations and with proper technique, they are useful in selected cases, not as a routine nor as the only treatment, but as an addition to our other remedies, especially in those cases which have resisted ordinary treatment and in which there is a marked infiltration of the tissues.

ACNE.

While X-ray therapy is applied by a few to all types of acne, it finds its greatest usefulness in the rebellious, indurated, deep seated, sluggish, stapylococcic pustular type, which have resisted all other measures. As a routine treatment the dangers to the face to exposure even with the best of technique outweighs its advantages over other tried measures. In every case the exposures should be given with caution; they should be mild and of short duration. The rays seem to exercise their greatest influence in those with coarse seborrhoeal and pale, pasty skins with a natural predisposition to acne and comedones.

Although the experience of operators seems to vary greatly as to the time necessary to effect a cure, it would seem that the more permanent results are obtained in those cases in which the exposures are given in cycles. The preponderance of opinion is to the effect that, though the time for effecting a cure is not materially lessened, cases otherwise incurable are much benefited and relapses are less frequent.

In ACNE ROSACEA the results are not brilliant. The influence is greatest in those conditions in which the glandular inflammation predominates. The effect on the

dilated blood vessels and upon the tumefaction of the nose is not appreciable. The treatment must be prolonged, though in those cases in which improvement is noticed, it seems to be shortened in comparison with other methods.

The same caution must be observed as in the cases of acne.

ECZEMA.

The chronic, infiltrated patch, found as a type in eczema of the hands and of the feet, will often yield to X-ray therapy, when it has resisted with a dogged persistence all other remedies. In selected cases of subacute inflammation it may be found useful, but it should never be applied to the acute stages of the disease except in cases of unusually severe and protracted pruritus, to the eczema of childhood, except in the most obstinate cases, or to an eczema otherwise easily managed. Some brilliant results are reported and it would seem that the duration of treatment is shortened, but recurrences are frequent.

PSORIASIS.

To the persistent, large infiltrated plaque or to the aggregation of smaller lesions which nothing else seems to affect with any degree of permanency, is radiotherapy applicable with the assurance of good resuts. The treatment must be prolonged and relapses are not infrequent. Reports are received of the successful treatment of psoriasis of the nail and of a few cases of generalized psoriasis, but on the whole, except in a few isolated cases, which have yielded quickly and apparently permanently to the influence of the rays, the story is one of repeated disappointment.

The claims of the early enthusiast have not been realized and such early claims seldom are. But in the hands of the competent operator, with the present more accurate means of measuring the dosage, and the gradual improvement in technique, X-ray therapy in general is finding its level and within its limitations the results are

more certain and permanent. Were the dermatologist more expert with the machine and did he give it his personal attention instead of relying upon the uncertainty of an assistant, and were the radiotherapist a better diagnostician of a dermatological lesion, more uniform results would probably be reported. The causes of failure with the one lies in his ignorance of his agency, and his improper technique; with the other, in his inability to recognize the true character of the lesion and its interdependence upon other constitutional conditions.

Ignorance, faulty judgment and inexperience of the operator (defective technique), over confidence and rashness or timidity in its use, (for I believe with the history of past mishaps as their precedent more men under than over expose), have done much to belittle the value of X-ray therapy. To this may be added as causes of failure, defect of machinery, uncertainty of reaction in the individual skin, inability of the operator from one cause or another to select cases appropriate for treatment, time and expense necessary to a successful outcome and uncertainty of results.

The dangers, namely, permanent telangiectasis, warty growths, burns, atrophy or increased and permanent pigmentation of the skin, growth of downy hairs, etc., should always be kept in mind. Fortunately the burn is of less frequent occurrence, but the dilated blood vessels, the atrophy, may not present themselves for several months after the exposures have been discontinued, even where the exposures have been mild and have produced little or no inflammatory reaction. (Hyde and Montgomery). And so we find that X-ray therapy is contraindicated in all types of acute inflammation or during acute exacerbation of a chronic condition and in childhood, when the skin is too delicate and dangers are too serious, except as a *dernier resort.*

The most successful practitioner will be he who combines an extensive clinical experience with a thorough knowledge of the principles and practice of Roentenology; he who, never neglecting an opportunity to improve his knowledge of the one, keeps himself abreast the advances of the other.

Drs. J. N. Hyde and F. H. Montgomery, Chicago.

We have found the Roentgen Rays a valuable aid in the local treatment of acne, acne rosacea, and some forms of eczema. In general, we find *the rays indicated in cases which resist ordinary treatment,* and especially in those cases in which there is a marked infiltration of the tissues. We believe the least recognized danger from the use of the X-rays in these conditions lies in the possibility of producing atrophy or disfiguring and persistent telangiectases. These unfortunate results may follow not only exposures which have produced distinct reaction, but may appear weeks or months after a series of mild exposures which produced little or no inflammatory reaction in the skin. We believe, therefore, that the X-rays should be used in these disorders with great caution, and the treatment should not be continued if, after a reasonable number of applications, good results are not apparent. We have found the X-rays a very convenient and effective means of removing patches of psoriasis, but as a rule the lesions recur as promptly as after other methods of local treatment. Although many cases of acne and of rosacea will yield to the influence of the X-rays alone, much better results are obtained when this agent is used (in smaller quantities) as an adjunct to systemic and other local methods of treatment.

Dr. Wm. A. Pusey, Chicago.

X-rays are in my opinion useful in acne, acne rosacea, psoriasis and certain types of eczema. I think they are useful in nearly all of the first three conditions, but I only use them in certain chronic types of sub-acute eczema. *I use them as the routine treatemnt in the first three. The treatment is not shortened, but the results are more permanent.* The results in these forms have been more successful than I anticipated. The difficulty about the treatment is that it has to be carried out carefully to avoid unpleasant effects, but with care it can be done and in my opinion with perfect safety.

Dr. A. Ravcgli, Cincinnati.

Exposures to X-rays in Acne and Acne Rosacea is absolutely unnecessary; we have other means, more reliable and free from danger which are beneficial in the named diseases. I have seen several cases of Acne treated by others with X-ray, with poor success.

In reference to Eczema I have exposed to the X-rays cases of *stubborn, chronic Eczema,* with some apparent benefits, for the first or second application, but continuing in the application it has proven not only useless but more harmful.

In Psoriasis in some obstinate cases the X-ray exposure has given good results, to remove obstinate patches, but after while they have returned and the benefit has been only a temporary one.

In my opinion the X-ray is not to be used as an ordinary means

of treatment of the named diseases, but *only in cases of extreme chronicity and stubbornness.* After two or three exposures, if there is no benefit, my advice is to stop the X-ray and use the ordinary treatment.

The cause of the failure of the X-ray in the four named diseases consists in the physiological action of the ray on the skin, which results in an inflammatory process. In chronic cases of Eczema, in chronic Psoriasis, the application of the ray activating the inflammation may be of some benefit; but when continued, the inflammation produced by the rays will increase the inflammation already existing and cause harmful results.

Dr. William Thomas Corlett, Cleveland.

1. The X-ray has been of some value in the treatment of obstinate cases of acne. It has not been uniformly followed by beneficial results, however. *I regard it as serviceable in very obstinate cases.*

In rosacea I have not persisted in its use. The few times I have used it not giving sufficient encouragement for its continuance.

I have not used it in eczema. In psoriasis it has a temporary effect in causing the lesions to disappear, as they have promptly returned, however, I do not consider it of much value in this disease.

2. I think its use should be applied to rebellious cases only.

3. In acne I think the results are permanent.

The X-rays have been somewhat disappointing as a therapeutic agent. The cause of this failure I am unable to state. I regret that I am unable to give more definite data, as I have during the last year or two discontinued operating the coil, excepting in rare instances, the routine work being done at Lakeside Hospital.

Dr. L. Duncan Bulkley, New York.

First. I have not used the X-ray in acne, but cases have been shown at the Dermatological Society, in which much benefit was claimed from it; *its use is so irrational to my mind,* without the use of very complete internal measures, that I certainly could not advocate its use in this disease.

In eczema, it certainly is advantageous in connection with other measures in removing long standing thickened patches of the disease.

In psoriasis, we sometimes have very good results in removing old lesions; I have seen them disappear in one single treatment; but in this disease, also, I could never think of using local measures alone and when employed the X-ray is an adjunct in occasional cases. I believe that it is contraindicated and harmful in conditions of the skin where congestion or inflammation exists.

Second. The X-ray exposures are in my mind to be used in any of these complaints, but as occasional aids in chronic and rebellious cases; used in these conditions, they will certainly often

shorten treatment. In psoriasis I have frequently seen lesions remain absent from parts that have been X-rayed, when they develop in other situations near by.

Third. The use of the X-ray has not been as beneficial as may have been anticipated from reports of some enthusiastic operators. I think cases of failure lie in the absence of dermatological knowledge and in the selection of cases.

DR. GEO. T. JACKSON, New York.

In some cases of chronic, and specially indurated acne, I have found them of the very greatest use, sometimes almost magical in their effect. I think it unwise to use them in the usual cases of acne.

DR. JAMES MACFARLANE WINFIELD, Brooklyn.

1. a. Beneficial in chronic eczema and psoriasis, of some benefit in rosacea, but not satisfactory in acne except perhaps in the old indurated cases. b. Only in chronic conditions, as eczema, psoriasis and indurated acne and hypertrophic rosacea. c. Contraindicated in acute conditions and I think capable of doing much harm if used in simple cases of acne (not to the disease under discussion), but may have postray results that are worse than the disease.

2. a. Not preferred as a routine, only useful in chronic and rebellious cases. b. In some instances, yes. c. I don't think so, except perhaps in rosacea.

3. a. More or less disappointing. b. Perhaps due to our lack of knowledge of the element employed.

I think the answers to your questions cover my experience in X-ray. I still think that, while it has not proven to be a universal dermatological panacea, it should be employed by all up-to-date men, for it does seem to be of benefit in many skin diseases, especially those of malignant character.

DR. PRINCE A. MORROW, New York.

My testimony as to the value of the Roentgen Rays in acne, eczema and psoriasis would be based upon the observed results in cases presented before the Dermatological Society by my conferees I have never used this treatment in this class of cases, believing that other and well known methods are to be preferred.

DR. WM. S. GOTTHEIL, New York.

1. a. *No. Absolutely.* (b) (c)

2. a. No effect at all in rebellious cases. Can do much better with other treatments in ordinary ones. (b) (c)

3. a. Disappointment. (b)

4. In all four affections we have other better, quicker and safer methods of treatment.

It is, in my opinion, entirely improper to ray acne, rosacea, eczema or psoriasis.

Dr. Jas. C. Johnson, New York.

As I do not use the X-ray at all in the diseases you mention, and so have no experience except what I have seen of others' work, I am not qualified to express a positive opinion. My attitude can be easily inferred from the foregoing.

Dr. Henry G. Piffard, New York.

Referring to the diseases named by you, would say that I have applied the X-rays in all of them except rosacea, but am satisfied that there are other methods of treatment that in a vast majority of cases are preferable.

Dr. H. H. Whitehouse, New York.

I do not use the ray at all and from results that I have seen and the uncertainty of the ultimate effect upon the skin structures, I *am very much opposed to their use in any disease that can be successfully managed by our older methods of treatment.* This would include your list of acne, acne rosacea, eczema and psoriasis.

Dr. S. Lustgarten, New York.

We are using the ray quite extensively and with gratifying results in localized forms of acute as well as torpid eczema, particularly in acne vulgaris. The results in acne rosacea, acne varioliformis, acne necrotica, bromide and iodine acne, folliculitis decalvans, as well as in psoriasis have not been as satisfactory.

Dr. Grover W. Wende, Buffalo.

In the treatment of acne vulgaris by X-ray, I would say that I had cases which improved marvelously under its influence after having tried almost all other methods without avail. The cases which do not usually improve under other lines of treatment and which *are stubborn and rebellious are those which are most likely to respond to the X-ray;* recurrences in such instances are less frequent. It should not be supposed, however, that all cases without distinction should be thus treated, nor do I believe that the cure necessarily depends upon internal reaction but upon various circumstances yet to be explained. The X-ray has proved itself, in the treatment of acne, to be of remarkable value, but it should not be considered infallible. The X-ray is also of great value in the treatment of the folliculitis which commonly accompanies Rosacea, although it is found to be insufficient in telangiectasis in the hypertrophic stage; other treatment in the way of local applications should, however, be employed first; if these fail then I would recommend the use of the Roentgen Ray.

I have found the influence of the X-ray in psoriasis very serviceable, but as a means of cure it is not to be recommended beyond that of previous modes of treatment. The intervals marking the appearance of lesions is increased, yet the lesions have recurred during

the period in which the X-ray was used. A bad feature of the X-ray relates to its use in treatment of the scalp as such involves a danger of removing the hair. The great merit in the treatment lies in the fact of the quick removal of the lesions on the body, thus shortening the duration and preventing the annoyance arising from disagreeable applications.

My experience in the treatment of Eczema with X-ray is limited and not very satisfactory. I should question its utility in the acute forms and even in the chronic its effects do not differ from those resulting from topical applications; the general health requires careful looking after in addition to the use of the X-ray.

Dr. M. B. Hartzell, Philadelphia.

I find the X-ray of decided use in certain forms of acne, eczema, and, to a less degree, in psoriasis. I have had no experience with it in acne rosacea.

I find it of most use in those cases of acne characterized by deep-seated, sluggish, livid lesions occurring in women with pale, pasty skins; and in patchy eczemas, such as occur so frequently upon the backs of the hands. I employ it only in cases which show a moderate degree of inflammation, *i.e.*, in chronic cases.

I think it difficult to give any very precise rule as to when it should, and when it should not be used.

I do not use it as a routine treatment, but only when other methods fail, or are slow in producing improvement.

In selected cases the treatment is materially abridged.

As to permanency of the results, the treatment is too new to say anything very definite about it. As the rays have been used more or less experimentally in the diseases under consideration, one can scarcely speak of their being more or less helpful than anticipated.

Until we know something more definite about the way in which the rays produce their therapeutic effects, we are in no position to explain failures in those cases in which their employment seems to be indicated; but, no doubt, a fair percentage of failures is due to defective technique.

Dr. Charles Lester Leonard, Philadelphia.

1. a. *Yes, in all.* b. I have used them mostly in chronic cases with uniform success. c. I have yet to see cases where they are harmful or contraindicated, but my experience has been limited to 20 or 25 cases.

2. a. Cases treated are generally referred when other treatment has failed, as my work is not specially in dermatology. b. The duration of treatment is certainly shortened, as most of the cases have been treated for years without cure. c. The results have been permanent, *i.e.*, one or two years or more without recurrence.

3. a. The treatment properly applied has been always satisfactory and the length of treatment is being lessened by gradual improvement in the technique. b. In the employment of rays of too high penetrating force or the half-hearted inexperienced employment of too weak a dose to do good.

I think if possible you should try to draw out the actual experiences of individuals in the development and employment of effective technique and dosage. These diseases are the ones in which the Roentgen Rays can make their most brilliant and effective cures when properly administered and a general understanding of the appropriate treatment to be employed would lead to such successes as would demonstrate to the general medical public the extreme value and efficiency of this method. I have had a number of cases and have cured them where other men have failed with the ray treatment because they did not know how or did not dare to use the ray effectively.

Dr. Douglass W. Montgomery, San Francisco.

1. a. The *value of the X-rays in the treatment of acne is indisputable.* Of course to speak of curing permanently a seborrhoeide by external treatment is unscientific, as the cause of the disease is not local, but constitutional, but in my experience the X-rays seldom fail to remove an existing outbreak of acne, and to keep down the eruption, if the treatment is repeated at suitable intervals. In the treatment of acne rosacea the results are not so good as in acne vulgaris. Some forms of eczema are greatly benefited by the X-rays, particularly eczema of the palms and also the extremely itchy dry forms of generalized eczema. Acute outbreaks of psoriasis are greatly benefited, sometimes cured, by the X-rays, but their action is doubtful in very old chronic cases, except in psoriasis of the nails. This treatment does not shield from future attacks. b. The X-rays are particularly beneficial in early stages and acute forms of diseases of the skin. c. I have not found the X-rays harmful unless improperly administered. No harm is done even in cases of idiosyncrasy if the operator carefully notes the effect of the Rays on the delicate skin of the patient and acts accordingly.

2. a. In grave cases of acne and eczema and in some forms of psoriasis (nails, recent acute outbreaks, etc.) it is advisable to use the rays as a routine form of treatment. b. The duration of the treatment is undoubtedly shortened in some cases, possibly in most cases. c. The X-rays alone cannot affect a permanent cure in the seborrhoeides (acne, eczema, psoriasis, etc.) unless proper attention is paid to internal medication, diet, etc., to remove or modify the constitutional basis of the disease.

3. a. Although far from being a ''cure-all'' as they were at first considered by some enthusiasts, the X-rays are, however, to be ranked among our most valuable therapeutic agents. Their value in

some diseases of the skin is well established, but, as regards some other diseases, they are still in the experimental stages. b. The X-rays are beneficial in some cases and powerless in others. This method of treatment has not come up to the extravagant expectations that some men at first formed of it, but such adverse criticism is always to be expected from those who are at first too enthusiastic.

Howard Morrow, M.D., San Francisco.

I have found Roentgen Rays very beneficial in acne, acne rosacea, in certain forms of eczema, and occasionally in psoriasis. I have not found it contra-indicated in any stage of acne, and when used in conjunction with other treatemnt the eruption will usually clear up quite rapidly. For eczema it is most beneficial in the chronic forms associated with much pruritus. In psoriasis, although the eruption frequently clears up quite rapidly, under radiotherapy, I think its use should be very much restricted, as recurrences are frequent. The rays are never harmful when properly applied, but if there is no benefit after one or two reactions, they should be discontinued, on account of the possibilities of permanent telangiectases and warty growths. As a general rule I think the rays should be restricted to rebellious cases only. In the above conditions the duration of treatment is shortened and more permanent results are secured.

For selected cases Radiotherapy has been a great help, and in no way can it be considered a disappointment. Cause of failures when applied to selected cases must be due to the inexperience of the operator.

Dr. Isadore Dyer, New Orleans.

1. a. I have obtained excellent results in selected cases of acne. I mean that the X-ray is especially beneficial in those cases of acne where the lesions are deep-seated, infiltrated and where they form stagnant abscesses.

In acne rosacea I have not used the X-ray.

In eczema I have not used the X-ray.

In psoriasis I consider the X-ray of service only as a dernier resort. I have been called upon in three instances to treat cases which have been seriously damaged by the use of the X-ray in psoriasis, where the burns produced disfigured the patient, often producing scars which were irremediable.

2. a. I believe that the X-ray is only an adjuvant to the treatment of the above cases and cannot be considered as remedial alone. In acne the duration of the treatment in cases where the X-rays are used is materially shortened.

3. a. Because of the views I entertain with regard to the rays I consider that they have been helpful in all cases in which they have been used. I would not think of applying the X-rays to simple

cases of acne due to gastro-intestinal disturbance, nor those which are the result of irregular functions of the genital or digestive apparatus.

4. You are aware that there are many dermatologists who look upon the X-ray as the sine qua non in acne, as in other chronic or special conditions; I am glad to here go on record as being among those who are conservative in the use of this remedy, while recognizing its value in such conditions as superficial epithelioma, parasitic diseases, lichenoid eruptions, etc.

Dr. H. R. Campbell, Chicago.

1. a. Yes, but particularly so in acne and eczema. b. In any stage of acne, chronic stages of eczema and rosacea. c. Dependent upon the individual case and for which we have no absolute rule or guide except reactions.

2. a. Not as a routine treatment. b. Question cannot be answered as put, applying to time of exposure, as different operators have different experiences and the length of exposure varies in accordance with the particular operator's ideas or experience. The time required to accomplish a cure I think is shortened. c. In my opinion, yes.

3. a. In acne and eczema, yes. In psoriasis and rosacea more or less of a disappointment. b. Hard to tell, but I would say that about 90 per cent of the men who assume to operate an X-ray outfit know absolutely nothing about it.

Dr. Wm. F. Breakey, Ann Arbor.

Some stubborn cases of seborrhoeic acne in vesico-pustular stages were decidedly benefited by the judicious use of the rays. So too some cases of chronic eczema with polymorphous lesions and with pruritus. I have not used the X-ray enough in uncomplicated cases of rosacea to make results trustworthy or valuable. I have treated a considerable number of cases of psoriasis-regional quite successfully with the ray, apparently greatly expediting the recovery in some of them, but unfortunately they did not stay cured any better than cases that recovered under other treatment.

It should be stated that in nearly all these cases the Roentgen Ray was used in conjunction with other appropriate measures, medicinal and external; and it would therefore be impracticable to say just how much credit should be given to the one or the other method of treatment.

As an aid in general treatment I think it may find a very useful place, but to be subject to the same considerations which determine the selection of other measures.

Dr. H. R. Varney, Detroit.

In the treatment of acne vulgaris and acne rosacea, with the X-ray, after six years' experience, my conclusions are as follows:

The experienced operator, who carefully measures the ray, and personally observes its action upon each individual case, need have little fear of any damaging changes to the skin structure, in function or appearance in treating either of these diseases.

The skin of the face will permit more ray, without harm, than that of any other portion of the body, because of its constant exposure, and the easily penetrated bony structure of the face. This penetration prevents the accumulation of any over stimulation of the skin structure, as is the case in parts of the body which contain bones of greater density, that dam back the ray.

If over-stimulation is feared, instruct the patient to sit in the sun, and discontinue the ray until it has subsided. The sun assists in checking a beginning erythema.

In the treatment of fifty odd cases of acne, the results obtained have excelled those of any other recognized treatments, both as regards the duration of the treatment, and the permanency of the cure. This has been true in results with patients who were most delicate blond type. The cases so treated four, five and six years ago show no evidences of atrophy of the skin or telangiectasis.

Dr. Rollin H. Stevens, Detroit.

Before answering your questions I must preface my statements by this one: If we are looking for a specific for any of the diseases mentioned, except perhaps psoriasis, we shall no doubt be disappointed, because they are not due to a specific organism, as we now understand them, and are dependent upon a variety of causes, both local and constitutional, which must be removed before a cure can be effected. And this will answer your question 3 (a) and (b) in part. As to (b) I should say further that a cause of failure may be in faulty technique, and without proper methods to gauge accurately the quantity and quality of the rays we cannot have a perfect technique. I believe we are now entering upon an era of scientific radiotherapy which will give us a perfect technique. In a general way I should say that in acne and rosacea a mild erythema should be produced in order to secure an amelioration of the symptoms. Unless we can gauge the dose accurately to the production of this result, I do not think we are warranted in most cases of acne risking a serious burn or a deforming atrophy of the skin. Unless some of the methods such as used by Sabouraud or Bordier will accomplish such regulation of dose, at present we are pretty much in the dark as to when our patient has had enough raying and is within safe limits.

1. a. The X-ray has been beneficial in the treatment of acne, acne rosacea, eczema and psoriasis. b. In pustular conditions of acne rosacea, in chronic infiltrated eczemas, and in most cases of psoriasis, except where active inflammation especially if the result of chrysarobin. Have caused a case of general, almost universal, psoriasis to clear up under three to five minute treatments to each

area repeated once. The improvement, however, appears to be but little more permanent than when accomplished by other methods, but the treatment is cleaner and less troublesome. c. The Roentgen Ray is of doubtful value if not actually contra-indicated in most cases. of mild acne of the face with our present knowledge of the dose and possible after effects.

2. a. I have never used the Roentgen Ray as a routine treatment. b. The use of a good lepismatic will assist in shortening the time of treatment much more than the Roentgen Ray. I believe the ray does shorten the time as compared with the usual treatment outside of the use of a proper lepismatic.

3. I believe that the Roentgen Ray has proven more or less of a disappointment in the treatment of these diseases because too much was expected of it. Like any other therapeutic agent it has its limitations and indications.

Dr. Burnside Foster, St. Paul.

1. Of great benefit in acne, acne rosacea and chronic eczema. Not in psoriasis, except in a few isolated cases where obstinate patches of the disease resisted other treatment.

2. As a routine treatment in acne. In chronic eczema I use it in those cases which resist other treatment. In acne the duration is certainly shortened and the results are more permanent. In one of my cases treated four years ago for a very extensive acne vulgaris and which has remained well ever since, there has developed an apparent "skin atrophy" which is unsightly.

I believe that case received too much treatment.

In my experience X-ray treatment has done much more good than I expected it would; for I approached it in the beginning very skeptically.

Dr. M. L. Heidingsfeld, Cincinnati.

1. a. I have found the X-ray to be of no material aid in my treatment of acne and acne rosacea. Both these affections respond very promptly and completely to remedies of a local and constitutional nature, without invoking the X-ray to their assistance. I have found it particularly efficacious in chronic circumscribed persistent forms of eczema, particularly those which are located upon the hands and which are unfavorably influenced by such local causes as changes of weather, the trade irritations, etc. I feel that the treatment of these forms of eczema would be a very unsatisfactory chapter in dermatologic therapy without the assistance of the X-ray.

The X-ray, however, possesses unquestionably therapeutic value and is of great assistance, often almost indispensable in persistent cases of psoriasis where the lesions are in the form of enlarged solid plaques and show little or no tendency to regress spontaneously or with ordinary treatment; and in all cases of chronicized psoriasis,

showing large lesions, and an entire absence of annular and serpigenous forms. b. The X-ray is relatively more efficacious in the more chronic stage and the more persistent condition of the respective diseases, in which it possesses therapeutic value.

2. a. The X-ray is employed by me as a matter of routine treatment in the chronic circumscribed persistent forms of eczema and only in the rebellious cases of psoriasis. b. My best results are obtained in dermatolgic work by daily exposures of only two or three minutes with soft tube, applied at a distance of eight to ten inches. c. I believe the results are somewhat more permanent when secured by the X-ray then by other methods.

3. a. The X-ray has been more helpful than anticipated in the treatment of some of the forms of eczema and psoriasis and less in some of the other affections mentioned.

Dr. Clarence E. Skinner, New Haven, Conn.

My experience in the use of the X-rays in connection with the diseases you mention is confined to two cases of acne vulgaris, one case of acne rosacea, and one case of acute eczema. I have never treated a case of psoriasis. The result was most excellent and has been permanent for a year in the two cases of acne vulgaris.

The case of acne rosacea was nearly but not quite cured by a year and one-half's treatment. The patient then became discouraged and dropped his treatment and I have not heard from him since. The case of eczema was a very acute excerbation about the external genitals and that portion of it which affected the external skin was entirely cured, the eczematous skin being replaced by normal tissue. That portion which affected the mucous membrane, however, was apparently unaffected by the ray. My limited experience does not lead me to feel justified in expressing opinions in answer to the questions you propound except in so far as that I would feel that the X-ray is a therapeutic agent, of marked value in these conditions and should be investigated.

Dr. Randolph B. Carmichael, Washington, D. C.

I have found that the ray is beneficial in the treatment of acne, acne rosacea, eczema and psoriasis, especially in chronic and subacute conditions. I think it of doubtful value in most of the acute cases. I use the ray especially in rebellious cases, and not as a rule as a routine treatment. The duration in many cases I believe to be shortened, and more permanent results secured in many cases, though I believe in psoriasis this is doubtful. The rays I believe when properly used as helpful as anticipated, but more or less of a disappointment in psoriasis. The cause of failure probably depends upon the experience of the operator largely, whether due to over or under exposure, in stopping treatment too soon. The majority of men probably under expose, while many who over expose go to too extreme a treatment.

Dr. Jos. Grinon, St. Louis.

1. a. Yes. b. The rays have been useful in my hands in all stages or conditions of acne and acne rosacea, the best marked results being in those cases which had proved most rebellious to other lines of treatment, *i.e.*, the indolent cases. In psoriasis it has had a limited usefulness in single or few old chronic patches. In eczema in similar cases, sometimes curing old stubborn plaques after all other measures had been fruitlessly exhausted. I have, however, used it very rarely in eczema, whilst I ray all my acne patients. c. In a general way, in all acute conditions. There is much here, however, which I have not yet learned to determine. In many cases I try the ray tentatively, not knowing what to expect.

2. a. Answer in 1 c. b. Yes, as a rule in acne, and in a few selected cases of psoriasis and eczema. c. Yes, in acne, I am not sure about the others.

3. a. In acne the ray has in all but a few cases exceeded my expectations. In psoriasis, perhaps on the whole, disappointing. In eczema it has come up to anticipations in the class of cases above specified. b. In improper selection of cases and in poor technique I have given more than ten thousand sittings and yet I feel that I know less of its technique than that of other agents which I use.

Although your questions are limited to four diseases, I will add that in my hands it far excells all other means in acne necrotica, having cured the worst case of this hitherto incurable affection which I ever observed.

Dr. A. H. Ohman-Dumesnil, St. Louis.

1. a. I have found the use of Roentgen Rays of benefit only in chronic eczema and in psoriasis. This answers b and c. I regard it as contra-indicated in acute acne, acne rosacea and eczema. It is of doubtful value in psoriasis.

2. a. I consider exposure indicated in rebellious cases only. b. The duration of period of treatment has not been materially shortened in my experience. c. Not in psoriasis. In the other diseases the Roentgen Ray treatment must be followed by medicinal.

3. a. The use of the rays has not come up to my expectations in the treatment of these diseases and it is a very difficult matter to have patients come for a requisite number of sittings, as the improvement shown is not satisfactory to them. b. The cause of failure is no doubt due to defects in the tubes, in the exact measurement of the ray, lack of knowledge of proper application and of the cases wherein it is applicable.

Dr. Geo. M. Mackie, New York.

1. a. Yes; I have found this treatment especially efficacious in acne and also very valuable in acne rosacea. In eczema and psoriasis the X-ray is much less valuable than in the two preceding conditions, but it is very useful at times.

b. c. This treatment appears to be very reliable, in fact almost a specific in acne vulgaris, under which I include acne indurate, pustulosa, etc. Very brilliant results can also be obtained in stubborn cases of acne simplex, punctata, comedo, etc. I have seen several cases of acute pustular acne which failed to yield to the usual methods of treatment, progress to a subacute stage, and responding at once to the X-ray. There is no contra-indication against the use of the X-ray in acne as applied to the disease itself, but inasmuch as the disease is usually situated upon the face and as this treatment is sometimes followed by cutaneous atrophy and other undesirable cosmetic results, it should never be employed until other methods have failed.

Rosacea. When combined with acne pustules, comedoes or a condition of seborrhoea the results are often very satisfactory. Brilliant results are often obtained in the hypertrophic form of the disease. In simple rosacea due to dilitation of the vessels and uncomplicated by the above conditions, the X-ray is of no value.

Eczema. I rarely use the X-ray in this disease because other methods of treatment are as a rule efficacious. The X-ray is contra-indicated in acute eczema and dermatitis unless accompanied by uncontrollable pruritus. In refractory cases of pustular eczema or impitiginous eczema this method is of service, also in papular eczema accompanied by severe itching and in infiltrated patches of squamous eczema of long standing. The X-ray may be employed with gratifying results in follicular eczema.

Psoriasis. Here also I rarely employ the X-ray, because the disease usually readily responds to the older treatments and the lesions are as a rule scattered over the body. That the X-ray will control psoriasis is of course well known. In very severe or obstinate cases the itching is usually overcome as a result of a few treatments while the lesions resolve much quicker than by any other local application. I have never seen a case of psoriasis that would not respond to this treatment. As in acne, no harm can follow the proper use of the X-ray in this disease, but psoriasis is often situated where the X-ray can only be used with great caution, for instance on the scrotum and the scalp.

2. a. To the rebellious cases only.

In acne, decidedly. In obstinate cases of psoriasis the duration of the treatment is decidedly shortened, but the ordinary case responds more quickly to other applications. In the few cases of eczema where the X-ray is of service, I think the time of treatment is also shortened.

c. In acne, yes. In eczema, possibly. In psoriasis, apparently not.

3. a. Like most beginners in radiotherapy I at first expected too much and was accordingly disappointed, but not discouraged. My faith and confidence increase with experience and I think in the

X-ray we have an agent of great value in the treatment of the diseases under consideration.

The mere fact that this treatment offers relief to individual cases formerly considered incurable, makes the X-ray indispensable. The danger of untoward effects is now reduced to the minimum.

b. The cause of failure in my opinion lies in lack of experience, care and judgment. The X-ray as a therapeutical measure should be used only by the specialist. An immense amount of time, study and experimenting is necessary to produce the required skill and confidence. It will not suffice for the operator to be familiar with the action of the ray upon the healthy and diseased skin. The only way one can obtain complete control of the X-ray is by studying its action when used for other purposes.

Dr. Henry Clay Baum, Syracuse.

1. a. I have had good results in the treatment of acne vulgaris by X-rays. I have no opinion of its usefulness in acne rosacea, eczema of the ordinary types or psoriasis for the reason that my personal experience in these cases is too limited to pass an opinion. b. The cases of acne selected for X-ray treatment have been recalcitant cases that come to me with a long history of treatments of the ordinary types, constitutional and local, all of which were ineffectual. I have believed these cases to be infections of the Gilchrist-Sabouraud bacillus. In these cases long continued courses of X-rays, carefully administered, to avoid atrophy and destruction of the blood vessels, resulted in complete and gratifying cure. Also scars of previous eruptions were minimized, softened, leveled and became almost unnoticeable. c. I believe that the use of the X-rays as a routine in these cases is irrational and mischievous since the lesions originate through constitutional causes which cannot be reached or permanently influenced by X-ray treatment.

2. a. It seems to me that the exposures can only be excused when applied in most unusual cases. b. In exceptional cases of acne and psoriasis chronic lesions which may continue to exist after the cause has disappeared, may be cured by X-rays; but in an ordinary case the disease, as a whole, is not benefited save that a temporary relief may be secured. c. In my observations, except in the unusual conditions noted, the results of treatments are not permanent.

3. a. Inasmuch as it is irrational to expect a permanent cure from the local application to a lesion which is the result of a constitutional condition, I have not anticipated benefits and consequently have not been disappointed. But from the number of patients who have consulted me, who have previously been treated by X-ray for psoriasis, eczema and various forms of acne without permanent benefit, I infer that many of my colleagues have been disappointed, if indeed they expected cures from these treatments. b. The cause

of failure to effect a permanent cure in these conditions lies in the fact that gastro-intestinal derangement, the various toxaemias, circulatory infirmities, bad hygiene and bad habits are not cured by X-rays.

4. In cases of psoriasis occurring on the face, hands and exposed parts, it is often desirable to clean up the lesion as rapidly as possible for the mental comfort of the patient. X-ray will frequently effect this after but trifling exposures. In chronic diseases where experience shows X-rays to be of tardy benefit, if any, the physician takes chance of accident, burns, atrophies and the development of vascular changes in the skin in susceptible subjects; whereby the results of such treatment become permanent blemishes.

The etiology and pathology of acne and its various forms, of eczema and psoriasis, should make clear the hopelessness of effecting any permanent cures through the instrumentality of any local treatment alone. Probably my experience in the use of X-ray in the group of cases you mention would have been larger were it not for the fact that I have seen so many accidents and disappointments in the practice of my colleagues.

I have three X-ray machines in my laboratory and employ them with satisfactory results in appropriate cases. I have not as yet injured a patient by their use nor used them in any case which was reasonably amenable to classic cure.

Dr. J. Rudis-Jicinsky, Cedar Rapids, Iowa.

In my experience there is no better treatment for acne than the Roentgen Rays, and their value in these lesions cannot be disputed any more. The only obstacle we find is perhaps the length of time necessary for the treatments, which must be given even for months. The results I have had have been good in all types of the lesion with only few recurrences, which were treated again. We have to be very careful, though, and know exactly in each individual case what we are after.

In rosacea the results are also very good, the dilated blood vessels soon disappear and the normal color returns to our satisfaction in a very short time. I have cases on record which in the last four years are well, and do not take the treatment any more.

In psoriasis my results were not so satisfactory, especially in acute cases, but in chronic cases, as in eczema, we had some marvelous results. It seems to me that this method has its greatest usefulness in the deep-seated, severe and indurated cases of chronic character, according to the behavior of the individual and his susceptibility to the rays. The pain and the itching in these and similar cases are soon controlled, and the effect on the metabolism marked after a few exposures; but to use the X-rays, or any other rays, in every chronic case in every lesion of whatever character as a routine treatment would be unjustifiable.

In nearly all the chronic cases we relieve the burning, tingling sensations and check the foul odor and the discharge of different dermatoses.

My answers would be therefore:

1. a. Roentgen Rays in the majority of the cases of acne, rosacea, eczema and psoriasis are beneficial, and, not only that, but in some chronic cases give results not obtained by any other method. b. In chronic cases the results are better. c. Where there is plenty of irritation in the lesion proper we should not irritate more, and be on our guard in regard to the susceptibility of different indi-diduals, protecting the parts not rayed with lead, making the opening large enough and a little further beyond the lesion and the margin of the same. In every case we have to test the tube and use in one case always the same tube, observing its behavior and action very carefully. Experience in this matter is better than all the new and all the other apparatuses for measurements, etc.

2. Treatments are given after the reaction according to each individual case, in rebellious cases every day perhaps, but not as a routine treatment, the behavior and action of the tube changing with all the other characteristics of every case, every day, or better at every exposure. b. The rays were not a disappointment to me, not expecting much from them in every case; the failures being due to the patients only, who did not like the length of time of the treatments or to such a state of the lesion, where there was absolutely no help any more, and the rays could give relief only. The general health of the patients has to be taken into consideration, too, and to depend on the local stimulation by the rays, leaving out the necessary tonic treatment, or internal treatments altogether would not do.

In my cases the results were permanent. In neurotic cases of eczema, the X-rays have been a complete failure. Otherwise in subacute and chronic inflammatory processes, or in all lesions where there was plenty of scaling the rays proved beyond doubt beneficial, especially if we take into consideration that many other treatments of local character are not so clean and satisfactory.

Dr. Harvey P. Towle, Boston.

1. a. Yes. b. The more chronic, sluggish stages. c. The acute stages.

2. a. Exposures not preferred as routine treatment and always as an adjuvant only. b. Oftentimes but not always. c. No.

3. A difficult question to answer, as at the outset extravagant claims were made, based on insufficient data. Later work modified early claims very materially so that now we know what to expect and do not expect the impossible. In this latter sense I have found them very useful.

Dr. M. B. Hutchins, Atlanta.

1. Roentgen Rays found beneficial in the treatment of acne and psoriasis and in a few cases of subacute and chronic eczema. b. All acne vulgaris and comedones, chronic, non- (dermatitis) exfoliative psoriasis—face especially. c. Contra-indicated in acute inflammations.

2. a. Best treatment for acne, best for facial psoriasis. b. Shortened in acne because seems only permanent cure. Not shorter in psoriasis. c. More permanent results in acne only.

3. a. Helpful and disappointing as above. b. Cause of failures not selecting cases, pushing to acute burn.

It is my routine treatment of acne vulgaris and comedones and psoriasis of the face, rosacea and acne rosacea disappointing. Eczema indicated in very few cases.

Dr. Mihran K. Kassabian, Philadelphia.

1. a. Yes, decidedly useful. b. In early stages can be prevented or rendered mild. c. Don't think it is contra-indicated; be cautious in treating the face.

2. a. As a routine treatment, in all cases in connection with hygienic and systematic treatment. b. So often takes several months or years to cure them, not shortened always. c. In acne often relapses occur in young persons, repeated small doses are necessary. ity. b. Failures in our technique and dosage.

3. a. Rays been helpful anticipated; depending on the sever-

4. These cases should be treated by an expert in connection with a good dermatologist; other treatment must be resorted to, not only depend on the X-rays alone.

I have had very good results in acne (acute and chronic). Small doses and repeated ones I believe are more useful than massive doses.

Dr. D. King Smith, Toronto.

I have found the X-rays beneficial in acne indurata, the cases were of long standing and ordinary treatment was not giving very satisfactory results. In some cases after making a few exposures I resumed treatments previous to exposing with the rays and cases improved greatly.

Psoriasis. In some very chronic patches X-rays were of great benefit, the patches cleaning up rapidly, in one or two acute cases I tried the rays on one arm and the ordinary treatment on the other. At first there was an improvement in the "rayed" arm, but not enough to warrant continuing with the X-rays.

Recurrence is as frequent after the X-rays as in other treatments, I found.

In some chronic scaly patches of eczema I noticed improvement, but I only gave a few short exposures and then resumed other treat-

ment. I only apply the rays in rebellious cases. I prefer to give ordinary treatment a faithful try, but I find, as mentioned above, that as an ''accessory'' the rays have proved most beneficial.

I have experienced more or less disappointment in the use of X-rays in cases mentioned, yet in acne indurata results sometimes have been most brilliant.

Failure is due, I think, often in not having well selected cases and I would not advocate routine treatment by X-rays, but in cases well selected (especially long standing cases).

The rays often prove in my experience most beneficial. Until we know exactly the ''dosage,'' if I may use the term of the rays, we will no doubt have more or less disappointment.

I am in the habit of using ''Sabouraud's pastilles'' and never expose a part beyond the time taken to have the color change.

In acne indurata I think the results with the X-ray are more permanent.

Dr. John McMaster, B.A., Toronto.

1. a. Yes. b. All stages of acne vulgaris, chronic forms of eczema, especially when there is a scaly, scabby surface. c. In the acute, inflamed conditions of eczema it is not so certain to produce permanent results.

2. a. I apply the rays only to the stubborn cases, especially the chronic forms. Other simpler methods should be tried first. b. Very materially in most cases. c. The results have been permanent in all cases up to the present as far as I know.

3. a. Yes, more satisfactory than any other form of treatment hitherto used. b. The employment of unsuitable tubes (too hard tubes). The radiant energy must be transformed into chemical action in the skin.

4. Great care ought to be used in securing very soft tubes so that all the radiations will be absorbed by the skin and thus avoid atrophic injuries to the deeper structures.

My experience has been chiefly with acne vulgaris and the chronic eczemas and has been satisfactory to me and gratefully received by the patients treated.

Dr. James Galloway, London, England.

In the case of the four diseases mentioned in your letter, we have used the method occasionally only and by way of experiment. Personally I have found the most advantage in cases of psoriasis. There are few cases of this disease which give very satisfactory results by this method of treatment, but only a few. The most successful case in my experience was that of a doctor, an old college friend of my own who has learned to use the Roentgen Rays in his own case. He has become quite a specialist in his own treatment and undoubtedly he is able to keep himself almost free of the dis-

ease. Previous to learning the use of the Roentgen Rays he was much troubled and often incapacitated as a result of his psoriasis. In some cases in which I have used the treatment, the results have not been so satisfactory, as by other methods, and the method of treatment is trying on account of its duration. I have never used the treatment in a case of eczema, and as I say only experimentally in acne and rosacea, where the results were not very encouraging.

DR. T. COLCOTT FOX, London, England.

I do not carry out the X-ray treatment personally, but I have occasion to send on many cases to colleagues who devote themselves to this work. The only experience of the X-ray treatment of acne I have is in cases of chronic acne indurata, where it proves very successful. I cannot understand how the rays can get rid of all the comdones which are the ground work of acne vulgaris, and I find the old treatment highly successful. No doubt the rays may be useful in obstinate patches of psoriasis, eczema and lichenification, but I would only use it in isolated inveterate patches.

DR. ARTHUR HALL, Sheffield, England.

I have had no experience of the use of the rays in the treatment of any of the diseases to which you refer, as I have never used them in such cases.

DR. ARTHUR WHITFIELD, London, England.

1. a. Yes, in acne, psoriasis, eczema with hypertrophy only, b. Acne indurate. Psoriasis, any localized patch.

2. a. Never as a routine treatment, quite unjustifiable. b. Yes. c. No.

3. a. Not much anticipated. Some help gained. b. Injudicious and indiscriminate use.

DR. H. G. BROOKE, Manchester, England.

1. a. In the treatment of acne we have found great benefit from the Roentgen Rays; not much influence on the comedo stage, but a marked and beneficial action in the staphylococcal pustular condition; also in the acne rosacea, and especially in the accompanying seborrhoea oleosa with permanent rosacea. With eczema and psoriasis I have personally no experience, though I have heard from my colleagues in London that the removal of psoriasis patches is only temporary.

2. a. I have never used Roentgen Rays in such cases except when they proved rebellious to other treatment; certainly never as a routine treatment. b. The duration of the treatment is longer than where other methods of local treatment suffice. c. Yes, the results are permanent if the treatment has been sufficiently prolonged.

3. a. The use of the rays in these cases has helped where other means have failed, but they are at present necessarily tentative

in each individual case, but successful enough to encourage reliance on them. b. This I am not able to answer, unless it lies in the extraordinary difference in the degree of reaction in the individual skin. The production of a transitory redness is usually necessary.

Dr. Leslie Roberts, Liverpool.

In reply to your questions relating to the X-ray treatment, I may say that *I consider the treatment of acne, rosacea, eczema or psoriasis by X-rays to be irrational, improper and utterly inadmissable on scientific grounds.* I am afraid that those who talk of "curing" these diseases by rays, do not clearly understand the nature of these diseases.

Prof. V. Neumann, Vienna.

I have had a great deal of experience with radiotherapy of acne, acne rosacea, eczema and psoriasis. There are cases which cannot be treated properly otherwise. Of course I use our older methods in combination with the Roentgen Rays. Acne of face and back is often cured radically by a few seances, but acne rosacea with tumefaction of the nose is only very little improved.

Chronic eczema, wet and dry form, yield often quickly to the new treatment, but not ulcers of the leg.

Psoriasis in its chronic patches ought to be exposed strongly to X-rays; the acute disseminated form needs only very weak seances. The disease is not cured radically, though.

The X-rays ought to be handled only by specialists; if there are none at hand, the rays ought better be replaced by our old methods of treatment. But a specialist with much practice will by the use of the dosimeter of X-rays (Sabouraud, Noire and Kienbock with millampere meter) always avoid burns; therefore, in his hands radiotherapy will never prove harmful.

Dr. J. C. White, Dr. J. T. Bowen, Dr. C. J. White, Dr. F. S. Burns.
(Massachusetts General Hospital, Boston.)
Courtesy of Dr. Charles J. White.

Our experience in the treatment of *acne vulgaris* with X-rays, has not met the favorable and even enthusiastic results expressed by some writers. Examples of this affection in which we have used X-rays, have, in a large majority of cases, been patients who had treated themselves with the commoner remedies for acne and, for the greater part, under the direction of skilled dermatologists. Except in a few instances, the results of treatment with X-rays have been practically failures. In a few cases satisfactory results were obtained. Those cases which have responded favorably have usually been in subjects with coarse seborrhoeal skins with a natural predisposition to acne and comedones.

While we have never had ill effect during or following the exposure of acne lesions to X-rays, beneficial effect has always been

doubtful; in the sense that, it has never seemed desirable to formulate a favorable prognosis beforehand. In substance, we cannot say that we have found in the X-rays anything approaching a specific influence on acne. They have come to be regarded by us rather as a useful auxiliary in occasional cases, but not one to be used except when simpler and less expensive remedies have failed.

In treating acne vulgaris, moderately low tubes are used; always with the aim in view that as many rays as possible may be absorbed by the skin rather than penetrate it. We doubt any permanency of results over methods of treatment.

As to the cause of failure: Theoretically X-rays should benefit acne, through their inhibitory effect on highly differentiated structures. The amount of X-ray exposure necessary to depress glandular activity seems to be a very variable factor, if one is at the same time to keep within the limits of safety, and probably, with safe exposures, much more time is necessary than we would desire. Therefore, before the action of the X-rays on acne lesions can be scientifically condemned, the patient in question should have many exposures over a considerable period of time; a procedure which is only occasionally justifiable on account of the time and expense involved. Generally speaking, acne does not respond as one would expect, theoretically, except in occasional instances.

Acne rosacea is frequently benefited by X-rays. The rosaceous element is diminished and the acne lesions modified. The same theoretical considerations would seem to apply to acne rosacea as to acne vulgaris.

In *eczema*, X-rays have been found to be eminently useful and beneficial in subacute and chronic conditions associated with inflammatory infiltration of the dermis and thickening of the epidermis. No harmful effects have been observed in the treatment of the above mentioned types of eczema. In acute eczema, on theoretical grounds, we have considered X-rays contraindicated.

As in acne, the use of the X-rays in the treatment of eczema has been confined to rebellious cases. The duration of treatment is frequently shortened and it has seemed, in some instances, that results have been more permanent. In fact, X-rays have proven a valuable adjunct in the treatment of chronic eczema. The action of the X-rays on eczema we have accustomed ourselves to explain by their selective action on the cells composing the infiltration in the corium, and by their stimulating effect on the process of cornification, thereby causing more active exfoliation of the corneum.

X-rays have been found to exert a favorable action on lesions of *psoriasis*. The chronic cases with large infiltrated plaques or aggregated smaller lesions have seemed most desirable for treatment. In approximately forty cases treated during the last five years, a very large majority have reacted favorably; i. e., the lesions have healed. Rebellious cases seem best suited for exposure on account

of the time involved. It does not seem probable that lesions of psoriasis healed under X-rays are more permanent than those healed by other means. We have in our records one case of generalized psoriasis, treated by X-rays, that has remained healed five years. Other cases have relapsed in a few months. Increased metabolism in the rete mucosum and stimulation of the process of cornification would seem to account for the favorable action of the X-rays in psoriasis.

PROF. DR. NEISSER.

Auf Ihre Anfrage erlaube ich mir Ihnen Folgendes zu erwidern:

1.) a.) Akne und Akne rosacea-Fälle haben wir sehr wenig behandelt und dabei keine besonderen Erfolge gesehen. Dagegen haben wir sehr gute Erfolge bei den verschiedensten Formen des Eczems und bei Psoriasis.

b.) Bei Eczemen kommen wesentlich in Betracht die subacuten und alle chronischen Formen, sowohl die squamösen tylotischen, wie die lichenifizierten. Besonders wirkt die Behandlung juckstillend bei Lichen chronicus Vidal, bei pruriginösen Eczemen und dergleichen.

c.) bei Nässenden Eczemen ist besondere Vorsicht geboten. Ebenso bei ganz frischen Eruptionen von Psoriasis, während die älteren inveterierten Plagues gut beeinbusst werden.

2.) Ich wende die Röntgenbehandlung immer neben anderen Behandlungsmethoden an, glaube aber bestimmt dadurch eine sehr wesentliche Verkürzung zu erzielen. Ganz sicher aber ist, dass sehr viele Fälle, namentlich von sogenannten chronischen Eczemen, die jeder anderen jahrelang fortgesetzten Behandlung getrotzt haben, durch Röntgenbehandlung sofort in günstigster Weise beeinbusst und zum Heilen gebracht werden konnten. In allen Fällen wird die Behandlung abgekürzt, oft auch die sehr lästige Salbenbehandlung ganz vermieden.

Was die permanenten Resultate anbetrifft, so sind sie bei Eczem zufriedenstellend. Bei Psoriasis kommen Recidive sehr häufig; wir haben aber doch schon oft festgestellt, dass die bestrahlten Plaques nicht wieder zum Vorschein kommen, sondern dass das Recidiv bisher gesunde Stellen betrifft.

3.) Von Enttäuschungen kann eigentlich nicht sprechen, denn wir sind gerade beim Eczem und bei Psoriasis bei jeder Behandlung Fälle zu finden gewöhnt, die sehr hartnäckig und schwer zu beseitigen sind.

4.) Hierzu möchte ich nur bemerken, dass die Röntgenbehandlung durchaus nicht Sache jedes Arztes ist, sondern nur von solchen geübt werden sollte, welche auf das Geaueste durch jshrelange Beschäftigung mit der ganzen Technik vertraut sind.

Betonen möchte ich auch nach meiner Erfahrung, dass es entschieden Menschen gibt, welche eine Idiosynkrasie besitzen und schon

auf die allergeringsten Dosen reagieren. Man soll daher jeden Menschen, den man in Behandlung nimmt, erst mit einer ganz schwachen Dosis behandeln und erst nach vierzehn Tagen eine zweite Bestrahlung vornehmen.

Dr. Max Joseph, Berlin.

1a.) Ich habe noch nis einen *dauernden* Einbuss der Röntgenstrahlen auf die Acne, Acne rosacea, Eczema und Psoriasis gesehen. Gewiss kommen Besserungen vor, aber *absolute* Heilungen habe ich noch nicht gesehen. Ganz besonders gilt dies von der Psoriasis, bei welcher ja die Bequemlichkeit der Behandlung mit Röntgenstrahlen dem Patienten imponirt. Auch ist in einer Reihe von Psoriasisfällen nicht zu verkennen, dass eine Abheilung inveterirter Psoriasis-plaques hierdurch zu Stande kommt. Aber nach mehr oder weniger langer Zeit stellen sich Recidive ein: Nun könnte man ja dann wieder die neuen recidivirten Plaques mit den Röntgenstrahlen behandeln, aber einerseits hat der Patient nun das Zutrauen zu der Behandlungsmethode verloren, und andrerseits rückt die Gefahr der Röntgenverbrennung doch zu sehr in den Vordergrund. Ich habe noch neuerdings solhce Fälle gesehen, die von der sachverständigsten Seite behandelt wurden und doch schwere Schädigungen irreparabler Natur nach sich gezogen haben, ohne eine Heilung der Psoriasis herbeizuführen. Im Gegentheil in manchen Fällen wirken alsdann die Röntgenschäden als so starker Reiz, dass neue Psoriasis-Eruptionen auftreten, wie wir dies ja von anderen Traumen auch zur Genüge kennen. Die Beziehungen zwischen Psoriasis und Reizung sind ja bekannt.

Genau dass Gleiche gilt für die Behandlung der Eczeme. Allerdings spreche ich hierbei nur von der Behandlung chronischer, inveterirter, tylotiformer Eczeme. Ueber acute Eczeme habe ich keine Erfahrung, da mir hierbei die Röntgenbehandlung zu gefahrvoll erscheint. Aber bei den chronischen Eczemen gilt genau dasselbe wie bei der Psoriasis: In manchen Fällen tritt eine Abheilung ein, welche hier allerdings auch einmal, wenn auch selten, dauernd ist. In andern Fällen kommen Recidive, in andern Verbrennungen trotz grösster Vorsicht und in andern Misserfolge vor. Der Grund hierfür ist uns im Wesentlichen unbekannt.

Dagegen habe ich bei der Acne und der Acne rosacea nie Erfolge gesehen. Es scheint mir dies auch ganz erklärlich, wenn man sich die Wirkung der Röntgenstrahlen vergeganwärtigt. Wahrscheinlich kommt es doch hierbei zu einer Contraction der Gefässe, welche längere Zeit swar anhält, aber später doch wieder nachlässt. Da sowohl die Psoriasis in einer primären Erkrankung der Gefässe des Papillarkörpers wie die Rosacea in einer Neubildung der Gefässe besteht, so ist es kein Wunder, wenn die für einige Zeit geschädigten Gefässe nach mehr oder weniger langer Zeit, wo die Röntgencontraction, wie wir sie einmal kurz benennen wollen, aufhört, auch wieder später ihre Schädigungen anrichten.

1b.) Nach dem eben Gesagten wäre as vielleicht möglich in den allerfrühesten Stadien der Erkrankung, wo die Gefässalteration noch nicht so stark ausgeprägt ist, auch dauernde Erfolge zu erzielen.

1c.) Die Beantwortung dieser Frage liegt in dem oben Gesagten schon enthalten.

2a.) Bei dem jetzigen oben skizzirten Stande unserer Kenntnisse ist die gewöhnliche Behandlung, die uns ja gute Resultate giebt und keine Gefahren mit sich bringt, vorzuziehen. Aber bei rebellischen Formen kann man die Röntgenstrahlen versuchen.

2b.) Man kann in Allgemeinen nicht sagen, dass die Dauer der Röntgenbenandlung eine kürzere ist als bei den bisherigen Methoden. Es giebt auch Fälle von Acne, Rosacea, Psoriasis und Eczem wo wir in verhältnissmässig kurzer Zeit zun Ziele kommen. Doch ist vielleicht in anderen Fällen die Röntgenbehandlung etwas kürzer.

2c.) Bei Psoriasis nein, bei den anderen Processen zweifelhaft.

3a.) Die Beantwortung dieser Frage liegt in dem oben Gesagten enthalten.

3b.) Die Grunde des Misslingens habe ich oben im Wesentlichen schon auseinandergesetzt.

4.) Auch die Beautwortung dieser Frage ist in dem Obigen bereits enthalten.

DR. J. DARIER, Paris.

Maintenant que nous sommes en possession de procédés précis de dosage et de mensuration des Rayons X, la radiothérapie peut être employée avec la certitude de no jamais nuire. Il est donc légitime d'en essayer l'efficacité dans une série de dermatoses contre lesquelles elle peut nous offrir une ressource peut-être précieuse. La collaboration de tous les hommes de la spécialité est désirable pour atteindre le but le plus rapidement possible.

Je m'empresse donc de répondre à vos questions, bien que, sur nombre de points, mes expériences soient insuffisantes ou trop peu avancées.

ACNE.—Dans l'acné polymorphe juvénile, dans l'acné pustuleuse, mes essais sont peu nombreux: je n'ai observé rien de favorable à la radiothérapie.

Une exception doit être faite pour l'acné profonde ou indurée; en pareil cas les irradiations m'ont paru utiles, surtout si on les fait précéder de cautérisations au galvano ou de scarifications profondes.

Acne rosacea.—Résultats douteux, peu importants, très lents, si on emploie la radiothérapie seule.

Résultats advantageux, plus complets, plus rapides et plus durables, si on pratique des scarifications, suivies—à 2 ou 3 jours d'intervalle—d'irradiations radiothérapiques (3 H. tous les 10 jours.)
Eczémas.—Je m'abstiendrai de toute appréciation, mes expériences, portant sur des eczémas très variés, ne m'ayant rien donné de probant jusqu'ici.

Un seul point me parait hors de doute: l'action très précieuse et très remarquable des Rayons X sur le phénomène prurit. Psoriasis.—Ici mon impression est franchement défavorable. Si, dans les placards anciens et indurés, on obtient une amélioration parfois rapide, elle est suivie d'une rechute et d'une extension du processus qui parait due à cette intervention. Ici les méthodes traditionelles sont de beaucoup préférables.

Dr. Leredde, Paris.

Je puis répondre de la manière la plus précise aux questions que vous me posez.

1o.) *Acne vulgaire.*—Je n'ai pas d'expérience suffisante de la radiothérapie pour me prononcer sur les indications et les contre-incations exactes, dans le traitement de cette maladie. J'ai employé la radiothérapie à titre *complementaire*, après disparition des lésions visibles, et pour empêcher les récidives. Les résultats m'ont paru favorables.

2o.) *Acne rosacee.*—Dans certains cas, résultats merveilleux et rapides, dans d'autres, échec complet.

Les lésions de l'acné rosacée sont facilement irritées par les rayons X; la technique doit toujours être prudents, il faut se servir de doses faibles (1 unité H par semaine, par exemple, et ne pas dépasser 4 H. Sous cette réserve, je n'ai pas trouvé d'inconvénients dus à l'usage des rayons X dans l'acné rosacée correspond à plusieurs maladies et nous ne savons pas distinguer tous les types morbides qui y sont compris.

3o.) Ci-joint un travail que j'ai écrit récemment sur la valeur de la radiothé dans l'eczéma avec mon assistant le Dr. Martial.

Cee travail n'autorise pas de conclusions bien générales. Il faut séparer de l'eczéma les cas de lichénification de la peau, dans lesquelles la radiothérapie est peut-être la méthode de choix, à condition d'agir a doses suffisantes.

Je n'ai pas d'expérience de la valeur de la radiothérapie dans *l'eczema*, en dehors des cas d'eczématisation aigüe rapportés dans mon travail.

4o.) *Psoriasis.*—La radiothérapie peut être mise dans le traitement du psoriasis sur le méme rang que les meilleures méthodes de traitement par les agents chimiques. Elle est d'un emploi difficile

There are cases of chronic, indurated *eczema* affecting a part or

dans les psoriasis étendus à cause du temps considérable qu'elle exige pour le traitement. Elle est plus agréable pour les malades que les pommades, etc, bien faite, n'offre aucun inconvénient.

Les résultats ne semblent pas plus définitifs qu'avec les méthodes chimiques. Echecs possibles, dans les cas à marche aigüe ou dans les lésions avec infiltration considérable et anormale du derme.

*EXTRACTS.

"Additional Observations on the Use of Roentgen Rays in Dermatology."

HENRY W. STELWAGON, Philadelphia.

In *Acne* I have still continued to get markedly favorable results in many cases, but wider experience has shown that it (radio therapy) is not of the same curative value in all cases, and in some has but little influence unless pushed beyond the safety limit. Moreover, relapses are also not uncommon, but not so common as with other methods. I have come to the conclusion that *its use in acne should be extremely cautious, and that it is probably best reserved for the obstinate and extensive cases.* The best and quickest results are, as a rule, only attainable after the production of a mild erythema. *The danger of atrophic changes should be borne in mind,* several such cases, as already referred to, having come under my observation. Such changes, it is likewise to be remembered, may not present for several months after exposures have been discontinued. Moreover, it is not improbable that in some instances, as patients state, it stimulates a downy growth of hair. Many cases of acne can, in fact, be treated just as well without X-ray exposures, especially if time is not limited; and even when the Roentgen treatment is employed, it is, in my opinion, wise to use it conservatively and in conjunction with the other known methods of treatment.

Its action in average cases of *psoriasis* is not such, considering the trouble and possible accidents, *as to commend its use in preference to the usual methods;* it should, in fact, *be reserved for obstinate and large areas;* and this conclusion can be asserted more positively than in my former paper. The same remarks hold practically true as regards its use in *eczema*—limiting its employment to *obstinate thickened areas, and to rebellious localized forms,* as for example, persistent eczema of the hands; in all such cases, however, especially the latter, it should be employed conservatively and with great caution. In eczema, otherwise easily managed, it should have no place, and in my opinion in eczema in infants, it should never be employed.

That its application should be extremely cautious and conservative in non-malignant dermatoses, and except in extremely obstinate cases, used more as an adjunct than as the sole remedy.

DISCUSSION.

Dr Charles W. Allen: He employed the ray as a therapeutic agent more than ever before, and he liked it better for certain diseases, but he had become convinced that it must be used with greater

*The Journal of Cutaneous Diseases for March, 1906.

care than had hitherto often been the case. Personally, he did not think it was justifiable to produce such an erythema as was shown in the photograph of one of the cases of acne exhibited by the reader of the paper. He did not agree with Dr. Stelwagon that it was necessary to produce such an erythema in the treatment of acne, and he thought that permanent changes in the skin might result therefrom. In the treatment of *acne,* the effect of the rays should be expended on the deep follicles and glands, and no effect on the superficial tissues was necessary. The latter could be taken care of with antiseptic washes, etc., but for the deeper structures, the rays were useful.

Dr. Louis A. Duhring referred to one disease which Dr. Stelwagon had not mentioned in connection with X-ray treatment, namely, *psoriasis.* He had employed it in this disease for several years, and on the whole, *his experience with it had been unsatisfactory.* He recalled the case of a man who had a patch of psoriasis, about the size of an adult hand upon one thigh. The X-ray had been applied at intervals for a period of six months, to this and other patches. At first, there was improvement, but to the thigh patch, without warning, a violent reaction set in, the inflammation with supporation extending down to the subcutaneous connective tissue. The patient was obliged to take to bed for some time. For six months prior to this occurrence, however, the rays had been used as stated, with a certain amount of benefit; then suddenly this violent reaction set in, accompanied with much pain.

Dr. Duhring said that in another case of psoriasis, with numerous small, extremely rebellious patches on the abdomen and chest, the use of the X-rays at frequent intervals for a month resulted in a brownish pigmentation which lasted nearly a year. In short, the speaker said, his experience with the rays in psoriasis had not been satisfactory.

Dr. Edward B. Bronson: The X-ray was a remedy which acted first of all most potently and most obviously on diseases in which the cellular layer of the skin was especially involved. Conditions of hyperkeratosis, as often occurred on the palms or soles, which were usually considered refractory to treatment, often yielded like magic to the influence of the X-ray. The same was true at times of certain forms of *eczema, particularly* that known as *eczema squamosum,* and also some cases of recurrent eczema of long standing and comparatively sub-acute in character, might be absolutely cured by the use of the rays, without producing the slightest inflammatory reaction.

Dr. Bronson said that some of the best results he had seen produced by the X-rays had been in *acne,* not of the simple type, but cases where other methods had been unsuccessful, and more particularly in *indurated acne.* In such cases it was essential to produce a decided modification of the follicles, and that he had seen done by the X-rays. The object was to produce just the necessary degree

of atrophy which usually required a slight erythematous reaction, a degree that would not seriously destroy the integrity of the skin, and yet would check its morbid activity. In such cases he knew of no remedy that could compare with the X-rays.

In *rosacea,* which was often associated with follicular disease, the effects of the rays were at times almost magical, especially in the pustular forms of the disease.

Dr. Thomas C. Gilchrist said he could indorse what the previous speakers had said regarding their use in *acne vulgaris.* In these cases, he had applied the rays until a mild erythema developed, or until the patient complained of itching or flushing at night. In *acne* his results had been good, although some relapses had occurred.

THE USE OF THE ROENTGEN RAY IN THE TREATMENT OF ACNE VULGARIS.

H. Rockwell Varney, M.D., Detroit, Mich.

American Journal of Dermatology, Vol. 10, No. 3.

....It is the most satisfactory of all known treatments of that disease....

....We all have had patients who have become thoroughly discouraged after having tried all universally recognized treatments with no permanent results of cure. It is to this class of rebellious cases that the Roentgen Ray has proven so thoroughly efficient. Because of the uniformity and permanency of the results obtained, the writer has applied it in preference to all other forms of treatment for the last five years. The treatment is agreeable to the patient, and the most obstinate cases can be cured in a few weeks, with no damaging results to the skin structure if the treatments are cautiously given....

My experience has been that no systematic, local or mechanical treatment, given singly or in combination, can produce so perfect and permanent a restoration of the normal skin structure, both in appearance and function, as that effected by the X-ray. This is true even of patients whose general health may be far below normal.

THE PRESENT STATE OF OUR KNOWLEDGE CONCERNING THE THERAPEUTICAL VALUE OF THE X-RAY.

By Burnside Foster, M.D., St. Paul, Minn.

(The St. Paul Medical Journal, September, 1905.)

....We undoubtedly have in the X-ray a therapeutic agent of immense value, one which, in proper hands, and in the hands of those who appreciate its limitations, is capable of doing an immense amount of good, and it seems to me that at the end of the

first decade of its history we are in a position to take a calm and dispassionate view of the whole situation, and try and place the X-ray where it belongs among our therapeutic measures....

Acne. The X-ray treatment of this disease, in all its forms, has been found to be *more satisfactory than any other method of treatment that I have ever used,* and my patients, almost without exception, have been delighted with the results obtained. The oily seborrhoea which so frequently accompanies acne disappears, the pustules dry up and the deep indurated papules fade away, leaving very slight, if any scars. *The treatment is slow and tedious in many cases, but the final results are excellent.* The disease frequently recurs, but the recurrences quickly yield to the same treatment. I always, of course, go into the question of diet and general hygiene with these patients, and make use of internal remedies where they are indicated.

Eczema and Pruritus. Localized patches of chronic eczema which have resisted local treatment will frequently fade away after a few X-ray exposures, and the itching is very quickly controlled. The X-ray has not a very wide field of usefulness in the treatment of eczema, but in some cases it is a valuable aid to other measures....

Psoriasis. In this disease my results have *not been satisfactory,* although in a few cases I have seen patches disappear which the ordinary local measures had failed to remove. The X-ray has apparently *no effect in preventing the recurrence of psoriasis.*

---

*OBSERVATIONS ON THE USE OF THE X-RAY IN THE TREATMENT OF CERTAIN DISEASES OF THE SKIN.

By Fred Wise, M.D., New York.

....Such lesions, for example, as *acne, psoriasis, seborrhoic dermatitis*—cases which, when properly treated, should yield to the physician's efforts— are *not included in the list of dermatoses appropriate for radiotherapy.*

Successful results can certainly not be obtained by men who have had no special training in dermatology; a certain amount of clinical experience in the handling of various forms of skin diseases, whereby one is enabled to compare the various methods of treatment, and to draw conclusions therefrom, is essential in every radiotherapeutist. Caution, it must be said, should be the watchword of all physicians who make use of the ray. Unless a certain amount of care is exercised in the application of each exposure, and unless the effect of each seance is carefully noted, very unpleasant and obstinate burns are apt to follow the administration of this powerful remedy.

*Medical Record, January 20, 1906.

There are cases of chronic indurated eczema affecting a part or the whole of the skin, and accompanied by severe itching which are very rebellious to the common methods of treatment; such cases of inveterate eczema, react very favorably to X-radiation; the pruritus disappears, the skin is softened, the induration and infiltration is lessened, the joints become limber, and the general health of the patient improves markedly.

It should always be borne in mind, however, that in order to achieve the best results the proper internal and external adjuvant treatment should be carried out in all cases, and not depend too much upon the X-ray. It cannot be too strongly emphasized that many of the rebellious diseases with which the dermatologist has to contend are due chiefly to errors of metabolism—that is, they are constitutional diseases with cutaneous manifestations; how obviously inconsistent it would be, therefore, to attempt the cure of a skin disease due to systemic derangement by means of radiotherapy alone.

Traitment de l'eczéma por la radiothérapie.

(Etude critique.)

Por Lerredde et R. Martial.

Revue pratique des Maladies Cutanies, Syphilitiques et Vénériennes, Août 1905.

DISCUSSION ON DR. BIDDLE'S PAPER.

Dr. Charles Lester Leonard, Philadelphia: The statements made by Dr. Biddle voice the opinion of dermatologists and of all judicious X-ray workers. I have never been called on as a dermatologist to treat a patient, but have always been called by dermatologists to treat patients for them after they had given up the case. Hence I have never seen an acute case, but only the chronic ones and the results I have obtained in these cases have always been very satisfactory. I have never treated a case of acute eczema. The cases I have treated have been chronic ones, but the lesions covered most of the different forms of the disease.

To understand the variations in technic essential to the successful treatment of eczema by the Roentgen method, the polymorphos expression of this disease must be understood fully. These variations appear frequently in the same individual, but often must be recognized in isolated manifestations. The intensity of the process being responsible for its characteristics, while it is chiefly confined to the epithelium, yet ulcerative processes, in severe cases, may expose the chorium, while secondary infection often complicates and masks the disease.

These varying stages point to variations in the resisting powers of the surrounding normal cells and those involved but not destroyed by the process itself. Variations in treatment are essen-

tial to its successful adaption, and are based on the manifest condition of cellular vitality each stage presents.

Eczema is one of the superficial conditions in which the Roentgen method has been shown to have power to promote the absorption, destroy pathologic cells, increase the vitality of the normal cells and restore the tissues to a normal condition without scarring. Since the disease does not threaten life, and the cure is undertaken for cosmetic reasons in the majority of cases, it is essential that the rays be used with the utmost care in order to avoid any disfiguring after effects. In the majority of cases the suderiferous glands and hair follicles are but mildly involved, and care must be taken not to injure them.

The etiology of eczema is unknown and the results of the Roentgen treatment have made it even more indefinite. They have shown that an agent acting in purely a local manner can cure cases of all degrees of severity and in all situations, the acute and the chronic, without systemic medication. These cures have been permanent and have been accomplished in chronic cases that have defied treatment for years. They have thus discredited the plea and theory of systemic deficiency, often advanced in chronic cases as a reason for their rebellious chronicity. They have demonstrated that this agent acting locally, by destroying pathologic cells and stimulating normal cells to renewed vigor, can restore the normal and insure permanent vitality to the tissues.

These results can only be accomplished by employing the Roentgen Rays in due proportion to the conditions present and the results demanded. It is an agent capable of producing effects varying from the mildest stimulation to the destruction of pathologic cells, absorption by normal processes or total destruction of the healthiest and most highly vitalized tissues.

An agent possessing such a wide variation in physiologic action must be used with circumspection, but if it is not used with sufficient energy, where the lesion demands it, successful results can not be expected. Those lesions that resist this method of treatment, resist it because the necessary quantity and quality have not been adapted rightly to the particular case in hand. While almost any kind of Roentgen treatment will cure a case of eczema if persisted in long enough, if Roentgen Rays of not too high penetrability are developed, the treatment is hastened and the results are best when the dose, in quantity and quality, is adapted to the particular characteristics of the individual lesion and case.

In determining this dose, the character of the lesion, its chronicity and the vitality of the patient must be taken into consideration. It is impossible to make cells grow and to cause pathologic processes to become absorbed unless there is nutrition to stimulate. Fortunately the theory of the systemic deficiency has become widely known, and the majority of cases come to us in good physical con-

dition. When this is not the case, general remedial measures to build up the system, if possible in conjunction with the family physician, are to be employed, as local stimulation and alterative effects cannot result in a cure unless the cells have something to build on. Increased nutrition is essential to increased vitality.

In mild cases simple stimulation is sufficient to produce healing, and mild stimulant doses should be employed. These cases are generally curable by older methods and they are seldom referred before they become chronic.

In the chronic squamous variety, with an absence of ulceration and infection, the local condition of the skin is poor, nutrition is low, and there is little vitality. In these cases too severe primary treatment is liable to result in a severe dermatitis. The alterative effect is to be produced and absorption stimulated, but not too rapidly. The tube employed in such cases has an equivalent parallel resistance of about one-fourth of an inch, while the cathode stream is distinctly visible. The platinum is placed six to eight inches distant from the skin, the current being regulated to one and a half to two milliamperes. It is better in these cases to avoid a new tube, or if a new tube is used, an aluminum filter should also be employed. New tubes of such low vacua are particularly active, and unless a milliampere reading is employed to gauge its action serious results to the vitality of the skin may result. Such severity of action is sometimes necessary in obstinate cases, but the clinical experience of the operator must guide him and experimental knowledge obtained by milder dosage in the same case must be obtained previously before so severe a dose is employed. In the chronic cases of the squamous variety such mild treatment and dosage should be continued until a mild erythema results, when treatment should be suspended until the results of the treatment can be noted. If the lesions do not yield a more severe dose can then be employed at longer intervals, say, twice instead of three times a week, and the healing process hastened, for by this time the vitality of the normal cells will have been increased so that they will not be endangered.

In the treatment of lesions on the face and in particular lesions of the squamous type and the variety known as orbicularis oris, the utmost care must be used not to exceed the erythema, although its production may sometimes be necessary, especially in the cracks at the angles of the mouth. These deeper lesions should be treated separately, through small openings in the protecting lead, and stronger doses should be applied until resolution and absorption take place.

In those forms of eczema where infection is present and secondary glandular infection can be noted, the treatment must be more rapid and severe. These cases generally have been subjected to severe treatments with caustics, cauterants and curetting until the tissues will withstand all but the most severe treatment. Powerful

and massive doses are demanded and can safely be applied if the operator's clinical experience has fitted him to note the necessary reaction immediately when it has been produced. Such treatment is dangerous in the hands of the inexperienced operator, but these cases demand such a treatment to effect a cure.

The technique of treatment thus consists in the employment of tubes of very low vacua, their effect to be varied by the distance of the tube and its platinum from the skin, the amount of current passing through the tube, the frequency of the application and the employment of filters, either of aluminum between the patient and the tube, or the coating of an old tube within itself. The variation in dose depending initially on the character and history of the particular lesion and the condition of the patient, and, finally, on the reaction of the pathologic and the normal tissues to the treatment employed.

In no line of therapeutics is the dictum more true than in Roentgen therapy that the best results are obtained by applying the remedy in physiologic dose to the individual patient, making it strong enough to accomplish the results and no stronger. One of the greatest defects in Roentgen treatment today is that timidity in dosage which is bred of ignorance and married to inexperience.

Dr. Russell H. Boggs, Pittsburg, Pa.: I have not treated acne, rosacea or eczema, except the very chronic cases. The successful treatment of acne by the Roentgen method is dependent on flexible technic which can adapt the dosage to the needs of each case. This can be illustrated by the following technic I have found necessary in the treatment of more than forty cases:

In treating lesions like acne, the greatest caution should be used to prevent any undesirable results. Then it is absolutely necessary to study the quantity and the quality of the rays. In the past I have been in the habit of employing a tube very low in vacuum, one which will scarcely show the bones of the hand, and with the anode placed at eight inches from the skin, and one and a half milliamperes of current passing. I give five to ten minute exposures, depending on the condition of the patient, until nine treatments are given. By this time I am usually able to determine the amount of radiation necessary to cure the patient. As it is for the cosmetic results that these cases are treated, and as it is necessary to vary the quantity of radiation necessary to produce the best and most uniform results, three weeks of trial treatment seems advisable. By this method of varying the amount of radiation my results have been quite satisfactory.

Again, in pustular acne, where the patient has been treated by the older methods, there is uusally scarring besides the acne, and these small doses of X-ray cause a large amount of absorption. Small doses of the rays seem more efficient to cause absorption than intense irradiation.

Acne rosacea, while very resistant, has yielded, but in every case that I have treated a mild erythema was produced. Then the treatment was discontinued until the reaction disappeared. During this period of rest I have the patient apply stearate of zinc with ichthyol. When raying the face irritating medication should be dispensed with. In acne rosacea it is usually necessary to produce an erythema a second and even a third time, in some cases. A good rule to observe is to always proportion the dose to the malignancy of the disease. In the cases that I have treated the treatment was continued for from two to three months in the pustular variety of acne. Some mild cases required more treatment, and they had a greater tendency to recur than the pustular form. No matter how excellent the results may be, a recurrence will take place in a small proportion of the cases, but that does not lessen the value of the Roentgen treatment. Further treatment will cause the lesions to disappear completely.

In some cases pustular and rosacea acne I have used the rays from a large arc lamp, and I believe results were produced quicker and with less irritation than where the Roentgen Rays alone were applied. In papular acne I have not noticed any advantage in using the arc light.

The recurrences can often be made to disappear by using a high frequency current. This seems advisable, at least, where the recurrence is only slight. My rule has always been to treat the acne with the least amount of radiation possible to affect a cure. As a rule, no reaction other than an erythema should be set up. The occurrence of a severe dermatitis should always be avoided in acne. If this is done, cutaneous atrophy ought not to occur.

In selecting an acne tube, take one which will maintain a uniform vacuum and which can be kept low. For the past two years I have never used a new tube in treating acne, because I wanted to be familiar with its action before any treatment was given where cosmetic results were expected.

The treatment of psoriasis by the X-ray is attended by considerable difficulty because usually large surfaces are affected by the disease. After the lesions have disappeared there is a great tendency for them to recur. It usually requires more intense radiation for a longer time than in acne. I have obtained the best results when I employed a low tube about ten inches distant from the body surface. With the tube at this distance, with from one and a half to two milliamperes of current passing, an exposure of fifteen minutes' duration, three times a week, is given until ten treatments have been given. This usually produced a marked erythema. Then another area is given the same amount of treatment.

The average time of treatment in three chronic cases which I have apparently cured by the Roentgen method was six months. It certainly requires perseverence on the part of the operator and

patient in order to affect a cure in many cases of chronic psoriasis.

Dr. Stevens: I want to voice my appreciation of Dr. Biddle's paper. In doing this special work we are all of us very apt to become very narrow in our ideas and to limit our therapeutics to the special agencies we are studying at the time. In the treatment of these diseases, as Dr. Biddle pointed out, we should study the individual case and not try to prescribe for the name of the disease, but for the symptoms and the indications as they arise.

In the Roentgen Ray we certainly have a very easy method of accomplishing some good results in acne, and, perhaps, that is the reason why we are prone to use it in preference to other methods. And yet, in the treatment of acne, we have demonstrated to our own satisfaction that we can accomplish results more quickly with other methods than we can by the Roentgen Ray. There is one agent that is seldom mentioned, especially in this country, because it is complicated and difficult to operate, and that is the use of the Finsen light. I think that in acne and in rosacea we can accomplish very much better results with the Finsen light than we can with the X-ray and without any danger to the patient. But its use is more troublesome and it causes some disfiguration while the treatment is going on by producing erythema and blisters; but the results are more permanent.. In carrying out this or any other local treatment we must not forget the constitutional predisposition existing in these cases.

Dr. Leonard spoke of increasing the nutrition of the cells. I did not understand just what he meant by that statement, but it seems to me that most cases of acne and eczema are due to over-nutrition rather than to under-nutrition. There is faulty metabolism in these cases. If we understood metabolism thoroughly, we should not have any trouble curing these conditions without the use of any local agent. Some cases of eczema are purely of local origin and local treatment—X-ray or some other local agent—will cure them, while cases with a constitutional basis will be but temporarily improved by such means.

In the treatment of psoriasis we should be especially careful. We all know that psoriasis when irritated for a considerable length of time has a tendency to degenerate and become epitheliomatous. If we do not succeed in curing a case of psoriasis very quickly with the X-ray we should not persist in its use for any great length of time because we already have an irritation there which is so likely to degenerate if the irritation is kept up.

I was very much interested in what Dr. Hyde said recently before the dermatologic section of the British Medical Association about the etiology of psoriasis. It is his idea that it is due to the exclusion of light. Of course, he has mentioned this before, but he emphasized it very strongly and brought forward a great deal of evidence in support of his view. If this be true, it would

seem that the longer frequencies—as light—might be of greater value in the treatment of psoriasis than shorter frequencies—as the X-ray. Where it was practicable to use the Finsen light in small circumscribed patches of long standing, I have been able to cure psoriasis in two or three exposures, while the long continued treatment of similar patches on the same patient with the X-ray failed to have very much permanent influence.

Dr. George E. Pfahler, Philadelphia: I think that the results in the treatment of these skin diseases can be divided into two classes. First, those that follow the technic used by men who understand the general underlying principles of the X-ray and the psychologic results it produces. In other words, men who devote their time and almost entire attention to this work. Second, the class of results that follow the technic of those who believe that all that is needed to do X-ray work is an X-ray machine; that class of men who believe that the nurse or anyone who can turn the switch of the machine can do X-ray work. If you sift the results carefully you will find that they can be placed in one or the other of these two classes.

This work deserves the most careful thought and the development of training and art in treatment in order to achieve the best and most uniform results. I agree with everything that Dr. Leonard said, but I do not want him to be misunderstood. We should use all known methods in treating a case of acne or any other skin lesion. That is the right thing to do. Use anything that is good for the patient, but I want to emphasize the fact that it is the X-ray that is curing the disease and not the adjuvant treatment. I have treated a number of cases of acne in which I paid absolutely no attention to any other condition except the skin disease and I gave them no other medicine and they got well. Perhaps they would have gotten well a little sooner if I had treated them more, but do not let the general profession get the idea that our results follow the general treatment and not the X-ray treatment.

DR. BIDDLE closing discussion: My purposes primarily is to teach the physician that in order to use the X-ray machine successfully in therapeutic work the same care, the same thought and the same education must be given to the work as the radiographer gives to the development of his plate. But I want to warn the men who are radiographers that they are not dermatologists, and I believe that the best results will be achieved not by him who relies upon X-ray therapy exclusively, but by the dermatologist who has been taught to use the X-ray machine with proper technic and who is by experience able to select the cases appropriate for this method of therapy. The treatment of skin diseases belongs to the dermatologist. Educate him in the proper use of his machine, and ray therapy will be accepted with greater faith by the profession at large.

I want to place this society on record as saying that the same care and education are necessary to use this machine in therapeutics as it is necessary to use it in diagnosis, and with your permission I shall publish the conclusions of this paper as the expression of the society.

FURTHER OBSERVATIONS UPON THE ROENTGEN RAY FILTER.

By G. E. PFAHLER, M. D., Director of the Roentgen Ray Laboratory of the Medico-Chirurgical Hospital and College, Philadelphia,

And JAY F. SCHAMBERG, M. D., Professor of Diseases of the Skin in the Philadelphia Polyclinic and College for Graduates in Medicine, Philadelphia.

The Roentgen Ray Filter (Pfahler—Archives of Physiological Therapy, November, 1905) which was described before this body a year ago, you will recall was based upon two or three principles. Roentgen discovered first that rays of different qualities were emitted from the tube; and second, that the first layer of a certain substance absorbed most of the rays peculiar to that substance (Quoted by Walter, Fortschritte a. d. Gebiete d. Roentgen strahlen, Vol. VIII., p. 297.) Walter, by a series of experiments, showed that various substances have a peculiar selective faculty for the rays.

Based upon the law established by Walter, it was reasoned that the skin, then, has a special selective absorbing power for the rays; and based upon Roentgen's laws, if we interpose a layer of skin between the tube and the patient this layer will absorb the rays peculiar to the skin and thus protect the skin of the patient. The interposition of normal skin is impractical. The best substitute is leather, which, when soaked in water, is practically the same as skin.

The clinical observations reported a year ago by the deviser of the filter have been in every way confirmed, not only by the authors of the present paper, but by a number of Roentgenologists who have made personal communications.

Read by invitation before the 7th Annual meeting of the American Roentgen Ray Society at Niagara Falls, N. Y., August, 29 to 31, 1906.

We have, however, been anxious to eliminate, as far as possible, the personal factors and the influence of the disease itself upon the skin, and to demonstrate conclusively the degree of value of this filter, and others, such as silver and aluminum. It will be recalled that Walter demonstrated that in general silver filters out hard rays, and that aluminum filters out the soft rays.

We chose for our experiment rabbits, because they were comparatively easily handled and because they gave a fairly large surface of skin upon which to make our observations. We have used in all to date fifteen rabbits. While our experiments began during the early part of March, the time has been too short to make all of the observations that we have in mind.

Our experiments with the leather filter, however, have been conclusive and we feel justified in reporting them.

We placed a rabbit in a small box. A portion of the top was removed so as to expose his back. A notch was cut into one end large enough to encircle his neck without letting his head pass. The neck was then placed in this notch and the lid closed so that it held the rabbit securely in one position. We consider this a good device to hold rabbits for such purposes.

An area four and one-half inches in diameter was exposed to the rays at a distance of four inches from the anode. This much of the technique remained the same with all of the rabbits.

Rabbit No. 1. Healthy. Half-grown. White. March 5, 1906, exposure 30 minutes; penetration 3-4 (Benoist); current passing through the tube 2 milliamperes (Roentgen ammeter); distance of the anode from the tube, 4 inches. The chromoradiometer of Sabouraud and Noiré was changed beyond tint "B." The anterior half of the exposed area was covered with wet leather, three-sixteenths of an inch thick, and the posterior half was free, and was allowed the full action of the rays. The rabbit was then kept under observation for one month. At the end of this time no effect of the rays was shown, so he was given another exposure of one hour, penetration 7, 2 milliamperes,

and four inches distant. The leather filter was used as before. At the end of the exposure he was found paralyzed in the lower extremities. He lived two days. Autopsy showed no effect from the rays, but showed fractures of five ribs and one of the vertebrae. This was also shown by the radiographs which we present. These fractures accounted for the paralysis.

This experiment demonstrates two things: First, that the chromoradiometer was not an index of the exposure required to produce alopecia, and second, that in experiments upon animals harmful effects, if any are noted, may be due to careless handling. These traumatic effects may easily be ascribed to the rays.

Rabbit No. 2. Healthy. Half-grown. White. March 5, exposure similarly to No. 1, 30 minutes, penetration 3-4; current 2 milliamperes; distance 4 inches. This rabbit likewise showed no effect in one month. April 6 he was again exposed one hour; penetration 7; current 1 3-5 milliamperes; distance 4 inches. Three weeks later, May 1, there was complete alopecia over the area not protected by the leather. May 25 this area was denuded of epidermis and very dry, harsh and wrinkled. The anterior portion, which was protected by the leather filter, remained normal. The unprotected area proceeded to ulceration and crustation, which continued until July 25, when the rabbit was killed. The protected area remained normal. The general condition of the rabbit had seemed to be good, and he continued to increase in size and weight. At autopsy no gross changes could be seem in the deeper tissues. A portion of the spinal cord was removed from beneath the ulcer, which is being examined microscopically. The probabilities are that nothing abnormal will be found, since no cord symptoms were observed. The exposed area showing the Roentgen ulcer of the skin is shown in the photograph, which was made immediately after death. Fig. 2. This same area of skin has been preserved in Kaiserling's fluid and is demonstrated before you.

This experiment shows positively that the leather filtered out the rays which are harmful to the skin. It also

indicates that the constitutional effects of the rays are not as serious as some observations by recent writers would indicate.

Rabbit No. 3. Healthy. Half-grown. Roan. March 6, exposure 2 hours; distance 4 inches; penetration 4; current 2 milliamperes. The anterior half of the exposed area was protected by leather; the posterior half was free. No reaction or any noticeable effect was observed for about six weeks. We concluded that no effect would be shown, therefore May 18, a second exposure was given of 1½ hours; penetration 2-3; current 2 milliamperes, and distance 4 inches. The anterior portion was again covered with *leather;* but the posterior portion was covered with pure *silver.* 11 millimeters in thickness (the thickness of the silver in the Benoist scale). One week later, May 25, no effect was shown. June 2, two weeks later, the hair became loose under the area which had been covered with silver. June 13 the hair had disappeared from the entire area which had been covered with silver. June 20 this area was dry and crusted. This condition continued until he was killed July 25. This photograph and the specimen which we present to you show clearly the line of demarcation between the area which had been covered by the leather and the one which had not. The portion which had been covered with silver shows complete destruction of the skin, while the part protected by the leather has remained normal.

This experiment is most interesting and seems to demonstrate that the silver allows the skin rays to pass through. There is a chance for error in this conclusion, however, because this same area which had been covered with the silver in the second exposure had been entirely free in the first exposure. It seems, however, that since practically six weeks had elapsed between the first and the second exposures, that any effect produced by these soft rays would have been shown in this time, at least if we can make any comparison between rabbit and human skin. In the second exposure we again only had very soft rays, therefore if the silver did not allow the soft rays to pass through selective-

FIG. I

ly, then they must have been obstructed and the second exposure produced no effect. Quantitatively this thickness of silver cuts off many times as much of the rays as the leather, as is shown by a comparative radiograph. Fig. 3. It seems, therefore, that the silver must have intensified the skin effect rather than diminished it. If this observation is correct it would confirm the experiment by Walter which shows that silver allows soft rays to pass, but cuts off hard rays. We hope by the experiment upon Rabbit No. 15 to demonstrate clearly the effect of the silver.

Whatever the effect of the silver may be in this rabbit, we have again clearly demonstrated the protective value of the leather filter.

Rabbit No. 4. Healthy. Half-grown. Maltese. Was treated the same as rabbit No. 3, but died in about a week after the second exposure, apparently from diarrhoea. The rabbits at this time had been kept in the cellar with poor ventilation, and were not well cared for.

Rabbit No. 5. Healthy. Half-grown. Black. March 8, exposure 1 hour; penetration 7-8; distance 4 inches; 1 milliampere of current. The anterior portion was protected by leather, the posterior was free. March 10 there was an erythema over the unprotected area. The other portion was normal. He died with diarrhoea May 15.

Rabbit No. 6. Healthy. Half-grown. Maltese. March 9, exposure one-half hour; penetration 7-8; 1 milliampere; distance 4 inches. The anterior portion was covered with silver, the middle free, and the posterior portion was covered with leather. March 19, the anterior of the exposed area, which had been covered with the silver, showed a distinct erythema, and thinning of the hair. No other change could be recognized in the skin.

The erythema and thinning of the hair in this rabbit in the area which had been covered with the silver would tend to confirm the interpreted effect of the silver in rabbit No. 3.

Rabbit No. 7. Healthy. Half-grown. Brown. March 19, exposure 30 minutes; penetration 7 inches; 2 milliamperes. The anterior half of the exposed area was cover-

ed with leather; the posterior portion was free. Ten days later, March 29, no effect was shown and the exposure was repeated one hour; penetration 7; current 2 milliamperes; distance 4 inches. April 10 there was no reaction and the exposure was repeated one hour, the other conditions being the same. This made in all three hours' exposure with a high vacuum tube, in a period of 39 days. June 2, or five days after the last exposure, and 44 days after the first, the hairs over the unprotected area seemed to be a little loose, but no erythema of the skin could be seen anywhere. No more distinct change was noted until January 27, when the long hairs over the unprotected area were much thinner than elsewhere, and were being replaced by short hairs. July 20, all the long hair in this area had been replaced by short hair, so that it gave the appearance of a "hair-cut," with this area about one-half an inch shorter than elsewhere. Two days later this rabbit escaped and was lost.

This experiment would seem to confirm what has long been observed that less skin effect is produced by a high vacuum tube and that the effect is shown at a much later period than by a soft tube. It also adds doubt to the serious constitutional effect which is being recently charged to the rays, for this rabbit remained the healthiest, fattest and most energetic of all. While no accurate weights were taken, it certainly increased in size and weight.

Rabbit No. 8. Healthy. Half-grown. Black. March 19, exposure 30 minutes; penetration 7; current 2 milliamperes; distance 4 inches. March 22, four days later, there was slight erythema on the posterior or unprotected area. March 29 the above exposure was repeated. April 20 showed loss of hair and desquammation of the skin. April 21 the rabbit died. The desquammated area showed a clear line of demarcation from the interior protected area. Fig. 4. As the photograph indicates, the hair and skin are normal elsewhere. Autopsy showed no gross changes in the other tissues.

This rabbit was only given one-third of the exposure that was given to No. 7, on the same days, with the same tube and under the same conditions; yet a beginning effect

Rabbit No. 2 Fig. 2

Rabbit No. 3. Fig. 3

was noted on the fourth day after the first exposure, though this was transient. This, then, proceeded to ulceration and the rabbit died before any effect had been observed in the companion rabbit, No. 7. This shows a probable individuality, even in rabbits.

Rabbit No. 9. Healthy. Half-grown. Roan. March 9, exposure 30 minutes; penetration 3; current 2 milliamperes; distance 4 inches. The anterior portion was protected by leather; the posterior portion was free. April 23 showed no effect. May 1 he died, apparently of diarrhoea. This was seven weeks after the exposure.

Rabbit No. 10. Healthy. Half-grown. Roan. Exposure the same and under the same conditions as No. 9, except that instead of using leather, silver was used. The exposure was repeated April 2. The rabbit died April 12. over four weeks after the first exposure. No effect was shown. No cause of death was found, but on account of the slight exposure as compared with the other rabbits, we believe it was not due to the treatment.

Rabbit No. 11. Healthy. Half-grown. Black. March 22, exposure 30 minutes; penetration 7-8; current 2 milliamperes; distance 4 inches. The anterior portion was covered with silver; the posterior portion was free. He died April 12, three weeks after the exposure. No cause could be found. No signs of irritation of the skin was shown.

Rabbit No. 12. Healthy;. Half-grown. Roan. March 22, exposure 1 hour; penetration 4; current 2 milliamperes; distance 4 inches. The anterior portion was covered with leather; the posterior portion was free. April 23 showed no effect, and the exposure was repeated one hour. May 2 the hair was lost and the epidermis desquammated profusely over the posterior portion of the back and left side. This proceeded to ulceration. It began 40 days after the first exposure and 11 days after the second. He died May 18, apparently from the Roentgen ulcer. The portion of the skin which had been protected by the leather remained normal. A photograph was made immediately after death. Fig. 5.

Rabbit No. 13. Healthy. Half-grown. White. July 25, exposure 2 hours; penetration 2-3; current 2 milliamperes; distance 4 inches. The anterior portion was covered with *aluminum* eight thousandths of an inch in thickness . The middle portion was free. The posterior portion was covered with leather three-sixteenths of an inch in thickness. By comparing the shadow cast upon the fluoroscope by layers of aluminum and by the leather, it was found that eight thousandths of an inch of aluminum cast a shadow approximately equal to that cast by three-sixteenths of an inch of wet leather. A record plate was made at the beginning of the treatment, showing the comparative shadows of the aluminum, leather and the Benoist scale, as exposed for one minute to the tube used to treat the rabbit, with 2 milliamperes of current and 18 inches distant. The leather and the aluminum cast practically the same shadow, and both are so faint that it is difficult to get any print from the negative.

This experiment was undertaken to determine more positively whether the leather protects because of the simple removal of the soft rays, or, as we believe, because of a selective absorbing effect. The aluminum is generally known to absorb soft rays, but it is important to decide whether it would give protection proportionate to the relative quantity of rays removed as compared with the leather filter.

August 9, fifteen days after the first exposure, no effect was shown, when a second exposure was given; 2 hours; penetration 5; current 2 milliamperes, and distance 4 inches.

This exposure was given on a very hot night, after a full meal, and the rabbit was compressed in a small box. Nothing abnormal was noted after the exposure, but the next morning the rabbit was dead. Autopsy showed the stomach over-distended with food. Nothing else was found. The liver and spleen were removed and are being examined microscopically. We believe that the death of this rabbit was due to exhaustion.

Rabbit No. 8. Fig. 4

Rabbit No. 12. Fig. 5

Rabbit No. 14. Healthy. Half-grown. Roan. Experiment to determine the relative value of aluminum and leather in filtering out the skin rays. Aluminum was placed over the anterior third of the exposed area, and leather was placed over the posterior third, while the middle was left free. August 12, 1906, exposure 1 hour; penetration 5; current 1 milliampere; distance 4 inches; weight of the rabbit at this time was 2 pounds. A record plate was made at the beginning of the exposure which shows quality of the rays used, and the relative shadows cast by the aluminum and the leather. This plate was exposed 1 minute at a distance of 18 inches, with a current of 1 milliampere. Fig. 1. August 18 there was no reaction and the exposure was repeated under the same conditions. The exposure was again repeated August 10, making three hours in all.

Rabbit No. 15. Healthy. Half-grown. Roan. Weight 47 ounces. Experiment to determine the character of rays absorbed by silver. Silver .11 millimeter in thickness (the thickness of the silver in the Benoist scale) covered the anterior third of the exposed area, leather covered the posterior third and the middle third was left free. August 12, exposure 1 hour; penetration 5; current 1 milliampere, and the distance 4 inches. August 13, exposure 1 hour, and August, exposure 1 hour, with the same conditions as in the first exposure.

Remarks on the above experiments:

Rabbit No. 1 died of a broken back and five broken ribs. This was shown both by Roentgenograph and by autopsy. The fact that it had been paralyzed after a prolonged X-ray treatment might easily have been interpreted as a result of the X-ray exposure. The servant who brought this rabbit to the laboratory injured it while placing it in the box. This indicates that great care must be taken in drawing conclusions of the harmful effect of the rays upon the constitution of animals experimented upon, when the great mass of clinical experience is contradictory.

Rabbits No. 4, 9, 10 and 11 died before the effect of the X-ray was shown. Some rabbits not treated by the

rays at all died. We have attributed these deaths to the unsanitary conditions under which we were compelled to keep the animals, namely, in a cellar which was poorly ventilated and poorly lighted, with the feeding carried on by inexperienced hands.

Rabbit No. 13 died after a second prolonged exposure. We believe this to have been due to an over-distended stomach followed by compression in a small box, with practically no ventilation except to the head; these factors, in conjunction with a two hours' exposure on a hot night, produced exhaustion. We do not believe that this death was caused by the rays, though we are having the liver and spleen carefully examined. This single exposure, however, was about 3,078 times as great as that given to the average patient in the treatment of deep-seated growths, in proportion to the size of the animal, time, distance, amount of current, allowing 150 pounds for the weight, 20 minutes, 12 inches distant and 1 milliampere of current. These factors should be kept in mind in drawing conclusions as to constitutional effect when experimenting upon animals.

Penetration of the Benoist scale of 5 seems to have the most decided effect upon the skin.

Rabbits No. 2, 3, 6, 7, 8 and 12 showed decided harmful effects to the skin where it was not protected by the leather filter, but that portion which was protected by the filter remained normal.

Rabbits No. 3 and 5 seemed to show reactions under the silver, but on account of these rabbits having had a previous exposure without this silver, no conclusions can be drawn. We must await the effect upon rabbit No. 15, which was exposed with the silver anteriorly, the leather posteriorly, and the middle free.

In conclusion we feel that we have demonstrated the decided protecting value of the leather in filtering out the skin rays, since this protection was given with soft, medium and hard rays.

Our experiments upon rabbits indicate rather clearly that there is a varying susceptibility to the action of the

Roentgen Rays, some rabbits remaining unaffected by treatment which in others produces pronounced structural changes. If this is true of the lower animals, it certainly should be the case in human subjects, a proposition which is generally but not universally credited by Roentgenologists.

DISCUSSION OF PAPER BY DRS. PFAHLER AND SCHAMBERG.

Dr. Henry K. Pancoast, Philadelphia: I have made general use of Dr. Pfahler's filter in all cases in which treatment was directed towards conditions situated beneath the skin, and have found that as a rule from two to three times as much dosage could be applied when the wet leather filter was used as could formerly be done without it. But still a dermatitis may follow, and a very severe one, too.

I would like to ask Dr. Pfahler whether he knows the relation between absorption by this filter and a certain depth of living tissue? For instance, when treating a carcinoma situated, say, half an inch beneath the skin, would the leather filter take out any of the rays which might be of therapeutic value in such a case?

Dr. George C. Johnston, Pittsburg, Pa.: I want to extend my personal thanks to Dr. Pfahler for calling our attention to this leather filter at the last meeting of the society. At that time I did not think that it amounted to very much because it was only a piece of leather, ordinary sole leather; whereas silver might prove more valuable as a filter. I tried the leather, however, and the result is that I adopted its use as a routine procedure in my practice after only a few trials. Since then I have not exposed anything, except the most superficial forms of epithelioma or lupus, without using the leather filter, although I use a much thicker piece of leather than he recommended. But I did not bother about wetting the leather because I did not find that it made any particular difference whether it was wet or dry. Since I have adopted that method, making those leather screens for all my tube holders, I have been able to increase the amount of the ray by practically one-half, and I have gotten very much better results. At the present time I would not think of treating any deep-seated condition under any circumstances without using the leather filter. In treating abdominal conditions, I use a piece of sole leather 14 x 17, placing it over the abdomen, and I find that it works very nicely; but ordinarily I have a piece of leather placed right on the tube screen. I use the ordinary Friedlaender screen or shield, the aperture of which is fitted with a piece of leather.

Dr. S. Mason McCollin, Philadelphia:—I also wish to pay tribute to Dr. Phahler. Even before he spoke of using a leather filter I had been using moist chamois skin, a double piece, with good results, but after he brought forward the wet leather, I used that all together. Between the two I have rayed one patient for nearly two years, a case of sarcoma of the thigh. She has come regularly at least twice a week, and a great part of the time three times a week, for ten or fifteen minutes each time, and she never has had a burn. which, I think, is a very good result, one which speaks well for the use of the leather as a filter.

Dr. Lewis G. Cole, New York City:—I would like to ask Dr. Pfahler a question with reference to a statement he made in connection with one of his experiments in which the rabbit was partly covered with silver, partly with leather and still another part exposed directly to the rays? Was there any difference in effect on the part that was uncovered and the part that was covered with silver, and was the action of the ray greater on the part covered with silver or on the uncovered part?

I do very little therapeutic work and my experience has been simply along experimental lines. About two years ago I conducted a number of experiments, none of them conclusive, however, which led me to believe that the interposition of some substance increases rather than diminishes the action of the X-ray.

He spoke of some rabbits being less susceptible to the rays than others, the dark ones for instance, if I understand him correctly. I found that to be true also in patients; brunettes are very much less apt to get a burn than blonds.

Where he made use of a rabbit after six weeks for another experiment and then observed marked symptoms, the question of accumulative action must be considered. I have observed that where a second picture of a person has been made, six weeks or more after the first exposure even though the exposures be only thirty seconds each, there was a change after the second exposure, a slow tanning or discoloration of the skin which lasts a long time. I fail to see how two exposures made so far apart of so short a duration can produce such an effect. Perhaps Dr. Pfahler can explain this occurrence.

Dr. Ennion G. Williams, Richmond, Va.:—I would like to have Dr. Pfahler tell us whether he thinks that leather possesses any specific property in filtering out the burning rays, or whether any other substance of the same density as leather would have the same effect. Sometime ago I noticed that the hands of an X-ray operator were burnt rather severely, but the burn did not extend beyond the wrist. This operator was in the habit of wearing a thin canvas coat which seemed to filter out the rays that caused the dermatitis. The coat was so thin that it seemed strange to me that it should make such a material difference in the effect of the rays on the skin.

On the strength of that observation I experimented with the ray with a view to ascertain its bacteriologic effect. I found that three or four layers of gauze made a decided influence in altering the bactericidal effect of the ray. The gauze must have filtered out some of the rays.

Dr. H. W. Van Allen, Springfield, Mass.:—I had the pleasure of hearing Dr. Pfahler present this matter last year and I returned home feeling that we had at last been given a panacea for many of our ills. I tried the leather very thoroughly, I thought (but, perhaps, my technic was faulty), and I came to the conclusion that it postponed the clinical effect in the case of deep-seated growths, like carcinoma of the breast and tubercular glands of the neck, so that it became necessary to expose about twice as often or twice as long without benefitting the case in any way. I tried the leather for about three months and then discontinued its use.

In one case of tuberculosis of the glands of the neck I exposed half of the glands without interposing the leather and the other half I protected with the leather. Of course, the unprotected part became red very much quicker than the protected part. Then I placed over the reddened area a very thick piece of lead and then exposed the whole again, and I could not see, after giving nearly double the exposure to the one portion, but what the two sides got along equally well. The doctor's experiments are very interesting, but they must be substantiated clinically before we can accept their value.

Dr. William S. Newcomet, Philadelphia:—I had rather an interesting case which illustrates the fact that leather is of value as a filter. Last year, when Dr. Pfahler called attention to this matter, I had a case of sarcoma of the neck which was giving me a great deal of trouble. The patient had been under observation for two years. For about one year I was able to hold the sarcoma in check; in fact, it was reduced in size. The patient lapsed but returned after three months with the tumor again of its original size. I immediately started raying, operation being entirely out of the question. Two operations had been performed, and the surgeon was afraid to undertake a third. While under ten months treatment, daily, the growth continued to grow rapidly, extending all around the neck, and on the right side the mass completely filled the supra-clavicular notch, then treatment was started with the leather filter. The patient's skin over that area was well bronzed at the time, although not severely burned, while the leather filter was used exposures for half an hour at a time were given. In about two months time the growth had decreased considerably in size. I increased the exposure, at times, to an hour in duration. During this time the brown skin peeled off entirely and all that remains in that man's neck is a growth of about the size of an orange. I am sure that the good result was entirely due to this treatment, but it could not have been done without the vigorous use of the leather filter.

Dr. William H. Dieffenbach, New York City:—In Professor Bier's book on "*Hyperemia as a method of treatment*" he throws out the hint that possibly the therapeutic value of the X-ray and radium lies in the hyperemic effect which they produce. It occurred to me that if we filtered out the rays which produce a distinct dermatitis we are really removing the main factor in the treatment of some of these conditions. I have not been able to follow this proposition out any further because Dr. Pfahler's paper is new to me, but I would like to call attention to the fact that we may be removing from the X-ray the very factor which is supposed to be a therapeutic factor, thus diminishing the therapeutic value of the ray.

Dr. Charles Lester Leonard, Philadelphia:—I spoke last year, at the Baltimore meeting, of having used aluminum and gold leaf foil as filters to prevent X-ray burns. At that time I said that I was eliminating from the field in which the patient was an electrical effect. I continued after the Baltimore meeting to use the aluminum foil and I have found it to be of the utmost value in protecting the patient and more rapidly producing the effect I desired to get. You can, with the use of the foil, produce tanning of the skin much more rapidly and with greater safety to the patient than you can without it. It absolutely controls the production of a burn.

I have in mind one case, which I cite not as a criterion for others, but only to show the manner in which I have used the ray with the aid of a filter. The patient was very anxious to have the disease controlled. I gave him fifteen minute treatments, with the tube six or eight inches distant, three times a week, with from three to four milliamperes of current running through a medium tube. I used the filter. The skin has become deeply tanned. It is as black as is the skin of any patient whom I treated a year, but without any sign of a burn. I was rather timid about using such strong dosage, but the result has proven the efficiency of the treatment, and I merely mention this in order to show you what can be done by the use of the filter.

I do not agree with Dr. Dieffenbach that we are cutting off the therapeutic value of the ray, or even a part of it, by using the filter. The action of the ray may be, and it has been shown to be, on the trophic nerves and on the arterioles, but that is a late and not an immediate result. I am fully convinced that the use of filters will aid us in applying the ray more vigorously and effectively.

Dr. Pfahler, closing the discussion:—I could have cited many more instances of the value of the filter, but I did not wish to lengthen my paper unnecessarily. Therefore, I only cited my experimental work from which I thought I could draw more accurate conclusions, eliminating the effect of the disease and the varying conditions in the health of the patient.

Dr. Van Allen called attention to an experiment he performed which is interesting. He protected one side of the neck with a filter,

leaving the other side unprotected. Then he protected the side which had been exposed directly to the ray, and found that both sides got well at about the same time. Of course, we must bear in mind that in the healing of disease by means of the X-ray, nature really does the healing, and that it takes a certain length of time for nature to carry out its processes; therefore, the time required for both sides of this neck to get well hardly justifies the conclusion that the filter had no effect.

As to the question raised by Dr. Pancoast, the deep effects of the rays. I thought of all that, but I cannot answer his question now. I do not believe that much of the deep effect of the ray is cut off, because when we are using a very soft tube, which the experienced operator would not use for deep growths in one minute at eighteen inches distance, there is a very small amount of the rays absorbed by the filter. These rabbits were exposed at a distance of four inches so that the intensity of the ray is much greater, and I used a soft tube; whereas when using a hard tube the effect would be very much less. So that I believe that the amount of rays absorbed is not very great, although I do not know just how much that really is. You can, at least, double your exposure without cutting out one-half of the ray. I usually give an exposure of half an hour.

As to the filtering effect of other substances, gauze, etc. Of course, the skin is affected by the soft rays particularly, and there are many substances that would cut off a certain amount of the soft rays. Even the air cuts off some, and so will clothing and aluminum, and chamois, but I showed you a specimen of aluminum so that you could form an idea of the actual thickness of the aluminum that casts practically the same shadow as the leather, and I would like to know how the thickness of the aluminum that operators have been using compares with the specimens I showed you. To say that you are using aluminum without saying how much, is not sufficient. If you use enough aluminum to cut off the soft rays you get protection; but will the aluminum give as much protection in proportion to the quantity of rays absorbed as the leather gives.

I believe that leather absorbs specifically on the strength of the principles established by Roentgen and Walter, and for that reason I wet the leather so as to make it more nearly like skin. Some men, by using a thicker leather probably accomplish the same results as I do.

Another point that Dr. Pancoast brought out confirms what I said a year ago. I said that this was a preliminary report. Of course, it is possible to burn the patient even when you are using the leather because leather does not absorb all the rays, only a certain proportion. Roentgen said that the first layer absorbs most of the rays, but not all.

Dr. Van Allen asked a question about certain experiments which I did not report completely. I said that one rabbit died and that

another was used to complete the experiments conducted on this animal to show whether aluminum or the leather would give the most protection. That experiment has not been completed, therefore I could not formulate any conclusions. The same is true of the experiment in which I am using the silver. I will draw my conclusions when the experiments have been completed.

As to the effect of the hyperemia. The diseases we treat by means of the Roentgen ray are not the kind that have been cured by congestive hyperemia; therefore, even if we cut off the hyperemic effect, I do not think that we can say that we are lessening or removing the therapeutic power of the X-ray.

AMERICAN ROENTGEN RAY SOCIETY.

MINUTES OF THE PROCEEDINGS OF THE SEVENTH ANNUAL MEETING HELD AT NIAGARA FALLS, N. Y., AUGUST 29, 30 and 31, 1906.

FIRST DAY—MORNING SESSION.

The society assembled at ten o'clock, and was called to order by the president, Dr. Henry Hulst, of Grand Rapids, Mich.

On motion, the minutes of the previous meeting, as printed in the volume of transactions a volume of which had been sent to each member, were approved.

The report of the secretary being called for, Dr. Geo. C. Johnston reported as follows:

REPORT OF SECRETARY.

Mr. President and Members of the American Roentgen Ray Society: An attempt was made by your secretary to let every person interested in X-ray work know of the time and place of this meeting. Notice of the meeting was published in every medical journal in the United States, Canada and Mexico. All these journals were furnished with copy, which many of them copied in full; so that the meeting has been thoroughly advertised. In this notice was embodied an invitation to all persons desiring membership in the society to apply to the secretary. The result is that we have received a number of applications from very desirable men whom we might have been unable to reach in any other way.

The printed transactions for last year represent the expenditure of considerable time and effort on the part of your secretary, and I ask your indulgence for any mistakes that might have crept into the work. The proof of every paper was sent to the writer for his approval before it was inserted in the transactions. One thousand copies are far too few considering the value of the book to X-ray workers and others who are interested in this work. Repeated requests have been received from libraries in various parts of the country for back numbers of the transactions, which the secretary has been unable to furnish because the volumes are out of print.

It is the desire of your secretary to form, if possible, a mailing list containing the names of men from all over the world who are interested in X-ray work and to whom a copy of the transactions may be sent each year. I would request the members of this society to hand in the names of men whom they know would be glad to receive these transactions in order that such a list may be prepared and the volumes placed where they will do the most good.

On behalf of the exhibitors at this meeting, I wish to state that when I came up here a few months ago to make the necessary arrangements for this meeting, the question of obtaining power arose. The president of the Niagara Falls Power Co. informed me that they were in a position to supply unlimited quantities of lighting current and all the direct current at 110 volts that we would require. Having full confidence in his ability to do as he said, I let the matter rest there, but I now find that he is unable to do anything of the kind. We have plenty of lighting current, but a very small amount of direct current, not over 50 amperes, so that it is impossible to show any coil in the exhibit on a direct current working up to its capacity, and the exhibitors will be forced to rely entirely on the lighting current. The indulgence of the society is asked in this contingency.

REPORT OF TREASURER.

The treasurer, Dr. Leavitt E. Custer, reported as follows:

Report of Treasurer, L. E. Custer, D. D. S., from Sept. 27, 1905, to Aug. 28, 1906.

Receipts—

Balance on hand	$ 12.80
Membership dues	725.00
Geo. C. Johnston from Exhibitors	525.00
J. G. Biddle, adv.	25.00
Ky. Med. Journal	1.10
Victor Electric Co.	25.00
	$1,313.90

Expenditures—

Badges	$ 16.00
C. L. Leonard, postage, etc.	20.00
P. M. Hickey, postage, etc.	20.00
Russell H. Boggs, postage, etc.	30.85
L. E. Custer, postage, express, etc.	15.99
Geo. C. Johnston, postage, express, etc.	77.75
Hotel Stratford, Baltimore, Md.	128.25
Banquet	46.00
Printing for Dr. Johnston	22.50
G. B. Vroom, printing	21.94
F. H. Baetjer, printing	11.75
W. G. Johnson & Co, printing	16.26
Brelsford Printing Co.	2.75
Bessemer Printing Co.	14.25
Jno. C. Bragdon, halftones	41.75
Murdoch, Kerr & Co.	600.70
Fred. C. Zapffee	125.00
Application fee of F. R. Boyd, ret'd.	5.00
	$1,216.73
Balance in Treasury	97.17
	$1,313.90

The secretary then read the resignations from membership in the society of Dr. Long, of Virginia, and Mr. Scheidel, of Chicago. On motion both resignations were accepted.

The scientific part of the program was then taken up, Dr. Vernon J. Willey, of Ann Arbor, Mich., reading the first paper entitled "The Teaching of Roentgenology in Medical Colleges." The discussion on this paper was opened by Dr. C. L. Leonard, and continued by Drs. K. Dunham, S. M. McCollin, P. M. Hickey, A. C. Mercer, Lang, H. Hulst, Lawrence and Willey.

Drs. Geo. E. Pfahler and Jay F. Schamberg, of Philadelphia, presented a paper on "Further Observations on the Roentgen Ray Filter." The paper was discussed by Drs. H. K. Pancoast, G. C. Johnston, K. Dunham, S. M. McCollin, L. G. Cole, E. G. Williams, H. W. Van Allen, W. S. Newcomet, H. W. Dieffenbach, C. L. Leonard and Pfahler.

Adjourned.

FIRST DAY—AFTERNOON SESSION.

The society reconvened at 2:30 and was called to order by the president.

The following papers were read and discussed jointly: "A Method of Estimating X-ray Dosage by the Measurement of the Electrostatic Field Surrounding the X-ray Tube," by Dr. Henry G. Piffard, New York. "A Resume of the Radiometric Dosage of Roentgen Ray Therapy," by Dr. Mihran K. Kassabian, of Philadelphia; "A New Direct Reading X-ray Meter," by Dr. Geo. C. Johnston, of Pittsburg; "Possibilities of Formulating a Standard of Radio-Activity," by Dr. C. E. S. Phillips, of London, Eng.

The discussion on these papers was opened by Dr. Leonard and continued by Drs. Geo. E. Pfahler, K. Dunham, H. C. Snook, H. W. Dieffenbach, R. Morton, E. G. Williams, A. L. Gray, E. W. Caldwell, F. Strong, R. V. Wagner, A. C. Mercer, L. G. Cole, S. Tousey, M. K. Kassabian and Geo. C. Johnston.

Dr. Reginald Morton, of London, England, followed with a paper on the "Advantages of the Use of X-ray Filters in Radio-Therapeutics," which was discussed by Drs. Pfahler and Morton.

Mr. H. C. Snook, of Philadelphia, read a paper on "The Induction Coil," which was discussed by Drs. Morton, Wells, Lawrence, Wagner and Snook.

Adjourned.

FIRST DAY—EVENING SESSION.

The society reassembled at 8 P. M., and was called to order by the fourth vice-president, Dr. E. W. Caldwell, of New York.

The president, Dr. Henry Hulst, of Grand Rapids, Mich., then delivered his annual address. He chose for his subject "Further Observations on the Roentgenology of the Stomach and Intestines."

Dr. Lewis G. Cole, of New York, followed with a paper entitled "Further Experimental Research Concerning Direct, Indirect and Secondary Skiagraphic Rays," the discussion on the paper being opened by Dr. K. Dunham and continued by Drs. Wells, Friedlaender, Tousey, Strong and Cole.

Adjourned.

SECOND DAY—MORNING SESSION.

The society reconvened and was called to order by the president, Dr. Hulst, at 10 o'clock.

The Chair appointed the following Nominating Committee: Drs. C. L. Leonard, H. K. Pancoast and E. W. Caldwell.

The secretary read the following applications for membership:

Mrs. E. F. Aschheim, San Francisco, Cal.

Nellie N. Barsness, M. D., East 10th street, St. Paul. Minn.

Carl Beck, M. D., 37 East 31st street, New York, N. Y.

Edgar Birdsall, M. D., Glens Falls, N. Y.

Lewis Gregory Cole, M. D., 616 Madison avenue, New York.

Albert M. Cole, M. D., 405 Newton Claypool building, Indianapolis, Ind.

Leighton R. Cornmann, M. D., 18 Park avenue, Rochester, N. Y.

Chas. Eastmond, M. D., 199 Madison avenue, New York, N. Y.

Wm. J. Fairfield, M. D., Anderson, Ind.

H. M. Fisher, M. D., Utica, N. Y.

Albert Freiberg, M. D., 19 W. Seventh street, Cincinnati, O.

J. C. M. Drake, M. D., Erie, Pa.

Albert Geyser, M. D., 1239 Madison avenue, New York.

Mugur Hagopian, M. D., Philadelphia, Pa.

Stanton Heck, M. D., Salem, O.

S. H. Heller, M. D., Lancaster, Pa.

Walter C. Hill, M. D., Lake Side Hospital, Cleveland, O.

Curtis H. Jennings, M. D., Fitchburg, Mass.

Wm. H. Johnson, M. D., 107 Wentworth street, Charleston, S. C.

Walter S. Lawrence, M. D., Memphis Trust building, Memphis, Tenn.

Alfred T. Osgood, M. D., 650 Madison avenue, New York, N. Y.

Joan A. Ospray, M. D., 1708 Oakdale avenue, Chicago, Ill.

Anders P. Overgaard, M. D., Commercial National Bank building, Fremont, Neb.

J. W. Pryor, M. D., Lexington, Ky.

Edwin R. Rasely, M. D., Uniontown, Pa.

John J. Rankin, M. D., Braly building, Los Angeles, Cal.

Chas. C. Sims, M. D., Dixie, La.

Homer E. Smith, M. D., Norwich Chemical Co., New York, N. Y.

C. E. Smyth, M. D., Medicine Hat, Alberta, Canada.

C. O. Sones, M. D., Panora, Iowa.

Hugh A. Stevenson, M. D., London, Canada.

H. P. Wells, M. D., 2313 Washington avenue, St. Louis, Mo.

Theo. D. Rupert, M. D., 164 Genesee street, Geneva, N. Y.

On motion the secretary was instructed to cast the unanimous ballot of the society for the election of these applicants to membership, which he did.

The following eminent foreign X-ray workers were elected corresponding members of the society:

Dr. George Fedor Haenisch, Klopstockstrasse 10, Hamburg, Germany.

Dr. Heinrich Albers-Schonberg, Klopstockstrasse 10, Hamburg, Germany.

Dr. Joseph Belot, 36 Rue de Bellechasse, Paris.

Dr. Rene Ledoux-Lebard, 18 Rue de Marronniers, Paris.

Dr. M. Beclere, Rue la Boetie 122, Paris.

The chair also appointed a committee consisting of Drs. Johnston, Pfahler and Boggs to draft a fee-table and report later during the meeting.

Dr. Ennion G. Williams, of Richmond, Va., contributed a paper on "The Tube in Roentgen Therapeutics." The paper was discussed by Drs. Gray, Newcomet and Kassabian.

In the absence of Dr. A. S. Warthin, of Ann Arbor, Mich., Dr. V. J. Willey read the former's paper on "Changes Produced in the Kidneys by Roentgen Irradiation."

Dr. H. K. Pancoast, of Philadelphia, contributed a paper on "Blood Changes Found after Irradiation in Leukemia, Hodgkins' Disease, Polycythemia and Pernicious Anemia." Both these papers were discussed by Drs. Geo. E. Pfahler, C. L. Leonard, S. M. McCollin, Bowen, H. W. Dieffenbach, Wells, Geo. C. Johnston, K. Dunham, and Pancoast.

On motion the paper by Dr. Carlo Colombo, of Rome, Italy, on the "Action of the Roentgen Rays on the Central Nervous System" was read by title and ordered published in the transactions.

The Executive Committee recommended that the society obtain permission from Professor Roentgen to publish the three articles written by him in the next volume of transactions. On motion the recommendation was concurred in, and the secretary instructed to secure the necessary permission from Prof. Roentgen.

The Executive Committee recommended further, the appointment of a committee of five, said committee to work conjointly with similar committees from foreign Roentgenological societies with a view to standardizing X-ray dosage.

The recommendation was adopted, and the chair appointed the following members on this committee: Drs. Johnston, Leonard, Dunham, Caldwell and Williams.

Adjourned.

SECOND DAY—AFTERNOON SESSION.

The society reconvened at 2:30 and was called to order by the president, Dr. Hulst.

Dr. Percy Brown, of Boston, read a paper entitled "A Roentgenological Study of Certain Manifestations of Syphilis," which was discussed by Drs. Pancoast, Pfahler, Wells, Kassabian, Baetjer and Brown.

Dr. Robt. Osgood, of Boston, contributed a paper on "The Differential Diagnosis of the Chronic Non-Tubercular Joint Diseases by Means of the Roentgen Ray." The discussion on this paper was participated in by Drs. Pfahler, Leonard and Osgood.

Dr. Chas. F. Bowen, of Columbus, Ohio, followed with a paper on the "Technic for the Localization of Foreign Bodies in the Eye," which was discussed by Drs. Pfahler, Hickey, Kassabian, Johnston and Brown.

Dr. F. H. Baetjer, of Baltimore, contributed a paper on the "Diagnosis of Renal Calculi." The paper was discussed by Drs. Leonard, Pfahler, Wells, Johnston, Hulst, Brown and Baetjer.

Dr. P. M. Hickey, of Detroit, Mich., read a paper on "The Diaphragm in Roentgenography of the Chest," which was discussed by Drs. Dunham, Pfahler, Kassabian, Mercer, Hulst, Wagner, Newcomet, Fairfield and Hickey.

On motion of Dr. Hickey the question of publishing prints shown to illustrate articles read before the society was referred to the Executive Committee, with power to act.

THIRD DAY—MORNING SESSION.

The society re-assembled at 9:30 and was called to order by the president, Dr. Hulst.

The following cablegram was read by the secretary:

Berlin, Aug. 21, 1906.

American Roentgen Society Meeting,
Niagara Falls, N. Y.

"Herzlichen Gruss und erfolgreiche tagung Deutsche Roentgen Gesellschaft Berlin."

Eberlein Immelmann Cowl.

On motion the secretary was instructed to convey the thanks of the society to the German Roentgenological Society for its good wishes and felicitations, and also to the British Electro-therapeutic Society for the kindly message received through its secretary, Dr. Reginald Morton, of London.

Dr. E. W. Caldwell, of New York, read a paper on "Skiagraphy of the Accessory Sinuses of the Nose," which was discussed by Drs. Pfahler, Gray, Brown, Cole and Caldwell.

Dr. Geo. E. Pfahler, of Philadelphia, followed with a paper entitled "The Measurement of the Diameter of the Pelvis and New Technic in Diagnosis of Vesical Calculi by Means of the Roentgen Rays." This paper was discussed by Drs. Gray, Kassabian, Dunham, Van Allen and Pfahler.

Dr. Andrew P. Biddle, of Detroit, contributed a paper entitled "The Accumulative Experience of the Profession in the Use of the Roentgen Rays in the Treatment of Acne, Acne Rosacea, Eczema and Psoriasis," which was discussed by Drs. Leonard, Boggs, Stevens, Pfahler and Biddle.

Dr. Kennon Dunham, of Cincinnati, presented a paper entitled "Personal Technic in the Treatment of Epithelioma." This paper was discussed by Drs. Williams, Pfahler, Dieffenbach, Wells, Boggs, Newcomet, Stevens, Biddle and Dunham.

Dr. A. L. Gray, of Richmond, Va., contributed a paper on the "Treatment of Malignant Disease of the Bladder through Suprapubic Incision, with Report of a Case," which was discussed by Drs. Johnston, Wells and Gray.

Adjourned.

THIRD DAY—AFTERNOON SESSION.

The society reconvened at 2:30 and was called to order by the president, Dr. Hulst.

The Nominating Committee reported as follows:

President, Dr. Preston M. Hickey, of Detroit, Mich.; Vice-presidents, Dr. Percy Brown, Boston; Dr. Sam'l Cummings, Toronto; Dr. Arthur Holding, Albany, N. Y.; Dr. Geo. E. Pfahler, Philadelphia, and Dr. Geo. H. Stover, Denver Colo.; Secretary, Dr. Geo. C. Johnston, Pittsburg, Pa.; Treasurer, Dr. Leavitt E. Custer, Dayton, Ohio. Executive Committee, Drs. Jos. F. Smith, Chicago; F. H. Baetjer, Baltimore, and Kennon Dunham, Cincinnati, Ohio.

On motion, the report, as read, was adopted, and the secretary was instructed to cast the unanimous ballot of the society for the election of the nominees to office, which he did.

The following papers were then read and discussed jointly: ''Ultimate Results of the Roentgen Treatment of Carcinoma of the Breast,'' by Dr. Geo. C. Johnston, Pittsburg; ''Treatment of Lupus Vulgaris by the X-ray,'' by Dr. H. W. Van Allen, Springfield, Mass.; ''Report on Tubercular Adenitis,'' by Dr. Russell H. Boggs, Pittsburg, Pa. The discussion was participated in by Drs. Dunham, Dieffenbach, Brenneman, Strong, Johnson, Wagner, Pfahler, Johnston, Newcomet and Van Allen.

Dr. Wm. S. Newcomet, of Philadelphia, read a paper entitled ''General Observations of Different Writers as to the Effects of the X-rays on Hair and Other Tissue Elements.'' The paper was not discussed.

The Committee on Fee-Table reported as follows: For examinations and work done in the laboratory of the operator—Sinus examinations, $25 to $50; location of foreign bodies in the eye, $25 to $50; examination of teeth, $10 to $75; diagnosis of renal and vesical calculi and gallstones, $50 to $200; examination of chest, $25 to $100; of shoulder, $25 to $50; of elbow, $15 to $50; of hand and wrist, $15 to $50; of foot and ankle, $15 to $50; of leg and knee, $25 to $75; of stomach and bowel, $75 to $200; of hip and pelvis, $50 to $100. For work done outside of the laboratory, from 50 to 500 per cent. additional, according to mileage.

On motion the report was adopted.

On motion of Dr. Pfahler, a rising vote of thanks was extended to the officers of the society for their faithful services in preparing so excellent a program.

Adjourned sine die.

JANUARY, 1907

AMERICAN
QUARTERLY OF
ROENTGENOLOGY

PUBLISHED BY THE AMERICAN ROENTGEN RAY SOCIETY

Volume I. No. 2

Next Annual Meeting
Cincinnati

September 25th, 26th
and 27th, 1907.

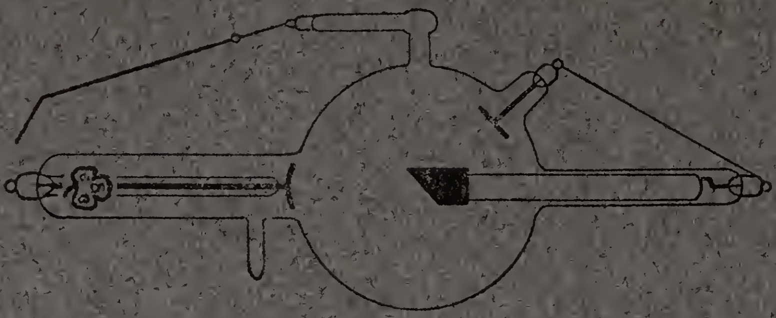
ONE DOLLAR
PER COPY

THREE DOLLARS
PER YEAR

PRESTON M. HICKEY, M. D. Editor
32 West Adams St., Detroit, Mich.

GEORGE C. JOHNSTON, M. D., Managing Editor,
611 Fulton Building, Pittsburg, Pa.

H. W. DATCHELER, Advertising Manager,
237 Michigan St., Toledo, O.



American Quarterly of Roentgenology.

Published by the American Roentgen Ray Society.

Business Office, 611 Fulton Building, Pittsburg, Pa.

American Quarterly of Roentgenology.

Published by The American Roentgen Ray Society.

CONTENTS

APPLICATION FOR MEMBERSHIP
IN
THE AMERICAN ROENTGEN RAY SOCIETY

I, ..., hereby make application for membership in

THE AMERICAN ROETGEN RAY SOCIETY

I am .... of age. I was born at .... and now reside at ....

.... I am a graduate of ....

from which I hold the following degrees; ....

....

My occupation at present is that of ....

I am now a member in good standing of the following learned societies:

....

....

Signature ....

We, members in good standing of THE AMERICAN ROENTGEN RAY SOCIETY, consider

.... to be well qualified to become a good and useful member of the Society,

and recommend that .... be received.

Signature ....

Signature ....

The Executive Committee hereby approves the above application.

Signature ....

Signature ....

Signature ....

EDITORIAL DEPARTMENT

THE ROENTGENOLOGIST AND THE GENERAL PRACTITIONER.

Roentgen diagnosis and Roentgen therapy have proved their value. The demand for expert knowledge and special experience in those who employ this method is an evidence that the general practitioner appreciates their value to his patient. Roentgenology as a special branch of medical science is the result of an increase in knowledge and the demand for its accurate and scientific employment. This demand for special skill is one of the acknowledgments of the value to the general practitioner of this method of diagnosis and therapy. Roentgenologists are admittedly the possessors of special knowledge and technic that is valuable to practitioner and patient but this admitted position carries with it responsibilities and duties to the practitioner and patient. The Roentgenologist is responsible to the medical world for the ethical employment of this agent, for conservative estimates in its study and adaptation to medicine, and for accurate information and demonstration of its value and its field of application by unquestionably better results.

It is the duty of the Roentgenologist to inform the general medical profession on these points, to demonstrate its progress; to show them where and how it can be of value to their patients; to warn them of the dangers in ignorant employments and to decry the exaggerated and baseless claims of charlatans and quacks.

It is the duty of the Roentgenologist to increase the knowledge of the medical profession in regard to the assistance which this method can render them in diagnosis and where better and more certain results can be obtained by its employment.

The burden of proof lies with the Roentgenologist. He should not say what he can do only, but demonstrate what he has done. Conservatism should mark his relations to the general profession. They can not be made to appreciate its value except by the demonstration of resutls better than those obtained by other methods. These results are accomplished, they must be repeatedly demonstrated. The Roentgenologist has a duty as an educator of the medical profession. He must keep his fellow practitioners conversant with the progress that has been made

and is making constantly in his special line of work. This can only be done by association with his fellow practitioners in local, state and national meetings. These meetings are for the dissemination of useful knowledge, and he should contribute his share in the interchange of thought. He has much that is valuable to demonstrate—results that prove the value to diagnosis, that show an advance in the treatment of disease, that mark steps in the progress of scientific knowledge. It is his duty to the profession to attend the meetings of the general medical public and by papers, demonstrations and open discussion help them to appreciate and realize the value of this more accurate method of diagnosis and most potent agent in therapy. C. L. L.

At the coming annual meeting in Cincinnati there will be a symposium on "Protection to the Operator." In the general discussion there will be afforded opportunities for the members to demonstrate with lantern slides the arrangements which they personally have found adequate and convenient. That this feature of the meeting may be productive of the greatest good, the executive committee would urge the members to prepare slides as the opportunity presents itself, so that they may be available when needed.

THE PRINT EXHIBIT AT CINCINNATI.

The interest in last year's print exhibit was so great that the committee feels that this feature of the annual meeting should be continued.

In order to insure the success of this undertaking and make it of value it has been decided to ask each member to furnish two negatives of each of the following subjects:

Osteo-sarcoma.

Tuberculosis of joints.

Renal calculi.

These negatives are to be of uniform size, 8x10 inches, and arrangements will be made for displaying them by means of permanent frames, arranged on the plan of illuminating boxes. The negatives will be permanently mounted with the films turned in and cannot suffer the slightest injury and no one need be deterred from exhibiting his choice negatives of the above named conditions.

In this way we hope to bring out a collection of negatives showing every possible manifestation of these conditions and which will be of practical benefit to every mem-

ber attending. Members that are not certain of attending the meeting may send plates to any member of the print committee and they will be returned promptly.

H. W. Dachtler, *Chairman*,
237 Michigan St., Toledo, O.

Percy Brown, M. D., 155 Newberry St., Boston, Mass.

Sidney Lange, M. D., Cincinnati Hospital, Cincinnati, O.

We would like to call attention of our members to the announcement of the print committee. The members having this exhibit in charge have decided to make the work displayed this year have a distinct educational value. This will be secured by having arrangements for the demonstration of a limited number of plates illustrating the subjects selected by the committee. It will enhance the value of this work and facilitate the labors of those in charge if exhibitors will make their selections early and communicate with the chairman as requested. If there is the active co-operation of a large number of the members, the exhibit will be a great feature of our next convention.

Now that the officers have decided when and where the next convention is to be held it behooves members to make plans to be present during all the sessions. While the program is not quite ready for publication, there is every evidence that a very instructive and interesting class of papers will be presented.

While this society has a large and active membership, there are many good workers to whom the society would be of great benefit and whose presence at our meeting would be of value. It would seem that each active member could secure one new desirable member. It would add greatly to the effectiveness of our society if it included all the representative workers in Roentgenology in America.

It has been suggested that there be formed three sections in our Association: An eastern, a middle section and a western. These sections could have a one day session so as to break the long gap between the annual meetings. This plan has been tried in some of the national societies of special workers and found to be very effective in promoting society interest. Now that we have our own official organ, the announcements of the meetings could be very easily arranged. This division into sections might be discussed at our meeting in Cincinnati. P. M. H.

THE AMERICAN ROENTGEN RAY SOCIETY AND THE AMERICAN MEDICAL ASSOCIATION MEETING AT ATLANTIC CITY, JUNE, 4-7, 1907.

The Philadelphia Roentgen Society has arranged for an exhibit of Roentgen negatives as a part of the Scientific Exhibit of the American Medical Association at Atlantic City.

The purpose of the exhibit is to demonstrate the scope and value of the Roentgen method of diagnosis. The exhibit will be made in the name of the American Roentgen Ray Society and plates will not be grouped under individual names of Roentgenologists or institutions.

The illuminated negatives will be grouped according to pathologic lesions and in anatomical sequence, with the diagnosis and name of Roentgenologist attached to each plate.

The Committee on Scientific Exhibit of the American Medical Association has reserved a limited space for the exhibit. The number of plates accepted from any individual must necessarily vary with the subject, the quality of the negative, their importance in completing a series and the total number offered. None but negatives of the clearest definition should be sent, as they must be appreciated by persons less experienced in reading them.

Kindly send a list of plates with subjects and size which you are willing to send for the exhibition to the Committee, and thus aid them in collecting a comprehensive, representative and educational exhibit. Good illustrations of fractures, dislocations and foreign bodies are wanted, more particularly rare cases, though the more common are of very practical importance. Lists of negatives should be sent immediately to the Chairman of the Committee, who will also furnish any information in reference to the meeting at his command.

For the Committee:

William S. Newcomet,
Thomas S. Stewart,
Charles Lester Leonard,
Chairman.

112 South Twentieth St., Philadelphia.

AMERICAN
Quarterly of Roentgenology

Volume I | JANUARY, 1907 | Number 2

FURTHER OBSERVATIONS ON THE ROENTGENOLOGY OF THE STOMACH AND INTESTINES.

PRESIDENT'S ADDRESS.

Henry Hulst, A. M., M. D., Grand Rapids, Mich.

DELIVERED AT THE SEVENTH ANNUAL MEETING OF THE AMERICAN ROENTGEN RAY SOCIETY, NIAGARA FALLS, N. Y., AUGUST THIRTIETH, 1906.

I little thought a year ago, when I had the pleasure of addressing you on Diseases of the Stomach and Intestines, that within so short a period of time I should to any extent worth recording find cause to change the technique and modify the views I then presented.

In grateful recognition of the work done by Professor H. Rieder of Munich I hailed his Roentgenographic Bismuth Method of examining the stomach and intestines as epoch making in medicine and as opening up to us a new and rich field in Roentgenography. To be able to determine with considerable accuracy the shape, size, and relative position of the stomach and colon, difficult, if not impossible by the methods of physical examination hitherto employed, deserved vastly more strenuousness than even the laborious Roentgenographic procedure required. For no gastro-enterologist, I dare say, ever looked for the first time at good Roentgenographs of these organs without being profoundly impressed by their diagnostic value, if not positively shocked by the striking inadequacy of the older methods which the pictures serve to reveal.

Two factors, a process of reasoning and an event combined to bring about my change of technique referred to. The reasoning was little more than drawing a logical conclusion to the premises laid down in my paper read in Baltimore. "For though in Roentgenography of early Phthisis intensifying screens are to be avoided because their use may defeat the very purpose of this work (the recognition of minute lung changes) the same objection can not hold equally in Roentgenography of the stomach and colon, in which we require detail less and contrast more."

If we can dispense with minute detail such as is only furnished by the photographic process without the use of intensifying screens, there is no inherent reason against, and there are many well recognized reasons for, the use of the fluorescing screen. An event gave the final impulse to the change. It was the publication of Holzknecht's "Mitteilungen." The author's first sentence unfortunately betrays a bias, and compels us to disagree; "Whithersoever we direct our gaze in radiological diagnostic we recognize a tendency to displace radiography by radioscopy." If his gaze had extended across the Atlantic he would have recognized nothing of the kind. On the contrary, American Roentgenology is steadily tending in the opposite direction. In spite of this prejudice—for aught I know because of it—and notwithstanding that Holzknecht gives scant credit to Rieder, to whom he is indebted for the impulse at least to his own work, he deserves our warmest gratitude for having initiated the second great step forward in the development of the new Roentgenology of the alimentary tract.

This is the way I now go about it. The navel is marked by a dime stuck on with adhesive plaster and the patient is stood up in a stall-like apparatus (shown upon the screen), between the properly adjusted movable arms of an orthodiagraph. In one of the hospitals I accomplish similar results by having the tube suspended in a box by means of weight, pulleys, fishline, and plummet in such a manner that when the tube is raised or lowered by the plumb-line the point of the plummet is always directly in line with the focus on the anticathode. This latter arrangement is very simple and inexpensive, and is usable to good advantage with a backrest for the patient and either a screen or a fluoroscope. The tube in this arrangement having vertical range of motion only, the patient himself must be moved sidewise to get ortho-

diascopic readings laterally, but it is very serviceable to examine in the upright position. No matter what device is adopted to secure orthodiascopy, the searching screen or fluoroscope should be lined with lead glass. The stall has sliding lead covered panels easily worked by ropes and pulleys to add to the protection afforded by the lead glass in the large searching screen of the orthodiagraph. Composition-gloves and apron and large lead glass spectacles add materially to the safety of the operator. Orthodiascopy without adequate protection is a foolish return to the dangers of the unsuspecting use of the fluoroscope in days gone by.

The room must be darkened completely, the eyes prepared for the work by remaining in the dark as long as possible, the tube and the valve tubes are covered with opaque jackets, except when using the plummet-graph and box, which hides the tube behind a roller curtain. The tube must be a fine one, must stand up well without getting soft and be thoroughly diaphragmed. It is impossible to do good work without the aid of diaphrams. This is universally recognized in Roentgenography but applies to fluoroscopy just as well.

Every requirement having been met, the next step depends upon the special purpose of the examination to be made. If this be with reference to gastroptosis and merely to ascertain what the ordinary methods of diagnosis seek to establish, half an ounce of bismuth subnitrate C. P. may be given in half a pint of water. A glance enables us to mark upon the patient's body the lowest point of the greater curvature, another to mark the lesser. Percussion of the gas distended or air inflated stomach in the prone position though generally practiced, is worse than useless as I hope to show. The only reasonable employment of this method is with the patient in the erect position, after the manner of Piorry-Penzoldt or Dehio. But as Dr. Richard Smith points out, "It is difficult to get readings in the standing position." By the orthodiascopic method, on the other hand we have succeeded in doing easily and accurately what was possible hitherto only with difficulty, "in a general way and roughly," and that moreover in less time than it takes to tell it. In this way large numbers of people may be examined with very little trouble, as for instance at recruiting stations and hospitals, and the necessary data obtained to settle for good the long standing question whether the vertical or oblique stomach is statistically

more common in men, women and children, and also whether the common and the normal are the same as applied to this organ.

The above procedure, so far from exhausting the method, is but one—one of the simplest moreover of many possible ways of using the method. Indeed it is capable of as many variations as there may be purposes for applying it. To follow out Holzknecht's unabridged scheme takes according to his own experience from 1½ to 2 hours, and this includes only the more important steps, by no means all that are conceivable. As in examining urine for albumen we do not go through the entire scheme for working unknowns, and as we do not start into motion all the mach inery of our entire diagnostic workshop irrespective of what the case may look like, so also we should not adopt and slavishly follow any stereotyped process for applying bismuth orthodiascopy to all abdominal cases alike.

The following general procedure, modifiable according to the conditions, expierience proves to be easy to carry out, not over elaborate, and exhausting to the patient, yet capable of bringing out a surprising number of important points in addition to those obtainable by the photographic method alone.

The patient is prepared as before and posed in the box of plummet graph or fixed firmly between the arms of the orthodiagraph. The stomach should be empty. In case of doubt, it should be washed out first. A seidlitz powder prepared by dissolving separately the contents of the blue and the white powder each in a half glass of water and is given to the patient in the order of soda first, and acid last. The reversed order of administering it may interfere with the rest of the examination by causing intense pain if the stomach happens to be ulcerated or hypersensitive. The tube, previously tested to read W. 5 or W. 6, is not started into action until now, and is never permitted to run uselessly. While marking orthodiagraphically the right and left diaphragm after ordinary expiration the space below the apex of the heart is seen to light up and to assume the familiar appearance encountered in fluoroscopy of the chest. Sometimes it resembles a pale moon rising out of the water, the water swallowed forming a straight line which shows ripples when the patient moves or is shaken, or, no water being visible; it may look like the moon breaking through a cloud. The spleen and even the kidney, may grow visible. After a little the light area ceases to grow. Its upper

limit bounded by a portion of the diaphragm, is marked as well as the lower. Percussion confirms the indication by the screen. By comparing the position of the diaphragm before and after the use of the seidlitz powder, we ascertain the extent of the displacement upwards of the fundus thus produced.

While the light area is fading and contracting, but before the magenblase (the collection of gas in the fundus) has time to vanish we proceed to our next step.

The patient facing us is turned 45 degrees to the left, and made to swallow a capsule or bolus of 25 gr. of bismuth subnitrate. If he finds it too large to swallow, several smaller ones may be given instead. It is interesting to watch them as they glide down the œsophagus, or become arrested, as they often do. Two or three respirations or a little water suffice to start them on again, unless arrested by a stricture or sidetracked into a diverticulum. From a little to the left of the median line of the body they come down obliquely across the light area, representing the magenblase to seek a point upon its lower border.

The patient is now turned so as to face forward once more. With each inspiration the magenblaze is seen to become narrower and to lengthen downward. The capsules moving up and down with it might easily be taken to indicate the lower border of the stomach, all the more readily because they show no disposition to leave their place. A deep inspiration promptly disillusions us. As the diaphragm descends the blase pushes downward a glove-finger-like process, carrying the capsules with it, and as the blase ascends in expiration, the process shortens, thus leaving the capsules to sink lower down slowly.

Even now they may become arrested. By pressing against the abdomen we can make them go down, however, until they can go no further. We have found the lowest point of the greater curvature of the empty stomach, and mark it upon the skin. Permit me in this connection to show you by means of these illuminating boxes, two plates I showed you a year ago, as a sort of curiosity. They are of particular interest now as Roentgenographic illustrations of the process just described as studied on the screen.

Under the dome of the left diaphragm the spleen is visible, and to the right of it and shaped by it, the magenblase. On the bottom of the blase, where its finger-like

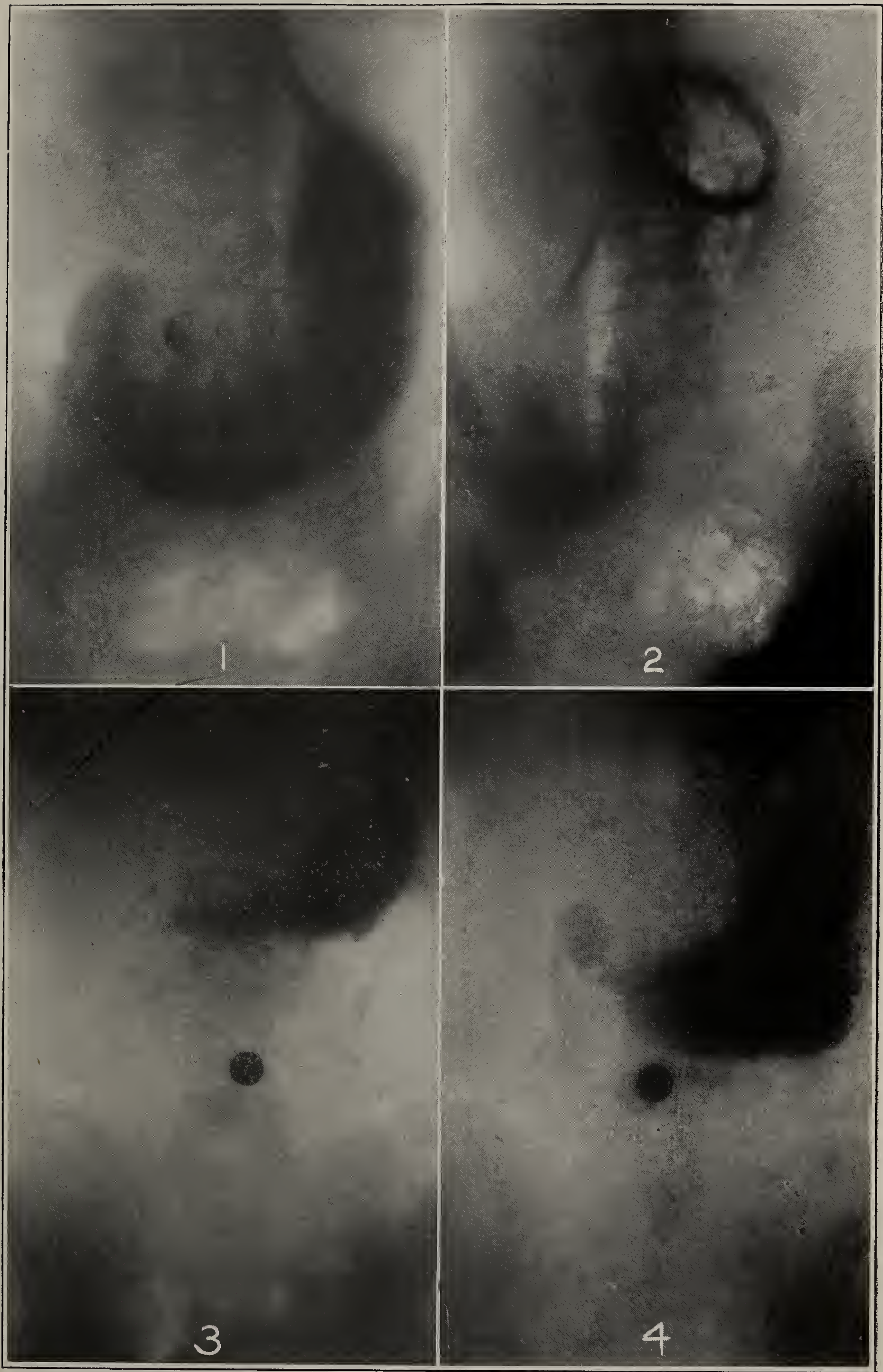
process forms during inspiration as described, two capsules with bismuth have become arrested in their downward course. Two inches lower is a group of seven capsules marking, no doubt, the caudal pole of this comparatively normal stomach.

No. 2. Taken about five minutes later, shows the upper two capsules still on their false bottom. Their relation to each other has changed a trifle. One of the capsules in the lower group has permitted part of its contents to escape.

The patient, standing as before, next drinks slowly, with constant stirring, three drachms of bismuth subnitrate in three ounces of water. After each swallow of the liquid, a black streak is seen running downward, outward to the left, then inward to the right, to a spot a little beyond the capsules, whose track it follows closely. By this means Holzknecht diagnosed an hour-glass stomach. Permit me to show you a plate to illustrate the necessity of proceeding cautiously to avoid being deceived by mere appearances.

This stomach has the blase above separated from the bismuth containing pyloric portion below by a firmly contracted middle portion, or corpus. Massage, or more bismuth, would have unfolded the corpus, for other plates of this stomach proved it to be quite normal in this respect. In another case Holzknecht found evidence of a cancerous deposit in the walls of the stomach when no tumor was palpable. The bismuth mixture instead of following the ordinary course described, spread out irregularly over the inner surface of the stomach and persistently avoided certain areas, which on post-mortem examination were found to correspond in general contour and location with nodulous deposits of the malignant growth. Although I have not yet been able to observe this condition myself, I am convinced of the diagnostic possibilities of this procedure, in all cases of suspected non-palpable as well as of palpable growths, in the stomach. Some of the pictures I shall have occasion to show later reveal the rugae of the fundus where there is but little bismuth. It is at this stage of the examination, therefore, while the stomach is not so full as to obliterate all details of its walls, that we should look for their structural alterations.

Thus far the patient has not left his place. He will now welcome the change to lie down on the examining table while he finishes the *piece de resistance* of the bis-



To Illustrate the Presidents Address

muth meal, an ounce of the subnitrate in one pint of milk. In the horizontal position, gravity permitting the deposit of the opaque substance in the upper two-thirds of the stomach, we take its outline before we let him up again for the final examination, which will be in the erect position. By turning the patient, placed horizontally, around the long axis of his body and examining him from both sides and above and below, we can fairly see all around his stomach. For the dorso-ventral view, the patient being on his back, the orthodiagraph may be adjusted for use in the horizontal position and utilized with the tube below. For examining the patient lying on the right side or the left, the apparatus is unsuitable, and we allow for the distortion incident to focusing the target perpendicularly to the dime fixed upon the back opposite to the one fixed upon the navel. The bilateral view is best obtained in the standing position, though it may be tried with the patient on his belly.

Horizontal dorso-ventral fluoroscopy face downward requires that the observer be on his back beneath the table, which is neither graceful nor pleasant, and as this position of the patient is precisely the easiest one for obtaining a brilliant negative it is sensible to make a virtue of necessity and take a picture instead.

In order to avoid the risk of tiring you by mere descriptions of what the observer may see on the fluorescing screen when examining the patient in these various positions, and yet present a clear though partial idea of it, I will show some negatives taken partly for this purpose.

Horizontal dorso-ventral view of stomach immediately after lavage and introduction through the tube of two ounces of bismuth subnitrate in one pint of milk. Tube left in. Patient permitted to breathe during exposure of 15 sec. on account of her feeble condition. Tube enters cardia at left edge of spine and crosses the fundus obliquely downward to the left until arrested at the greater curvature. Caudal pole one handbreadth below navel. Lowest point of lesser curvature opposite fifth lumbar vertebra. When standing caudal pole was behind symphysis pubis. (No. 1.)

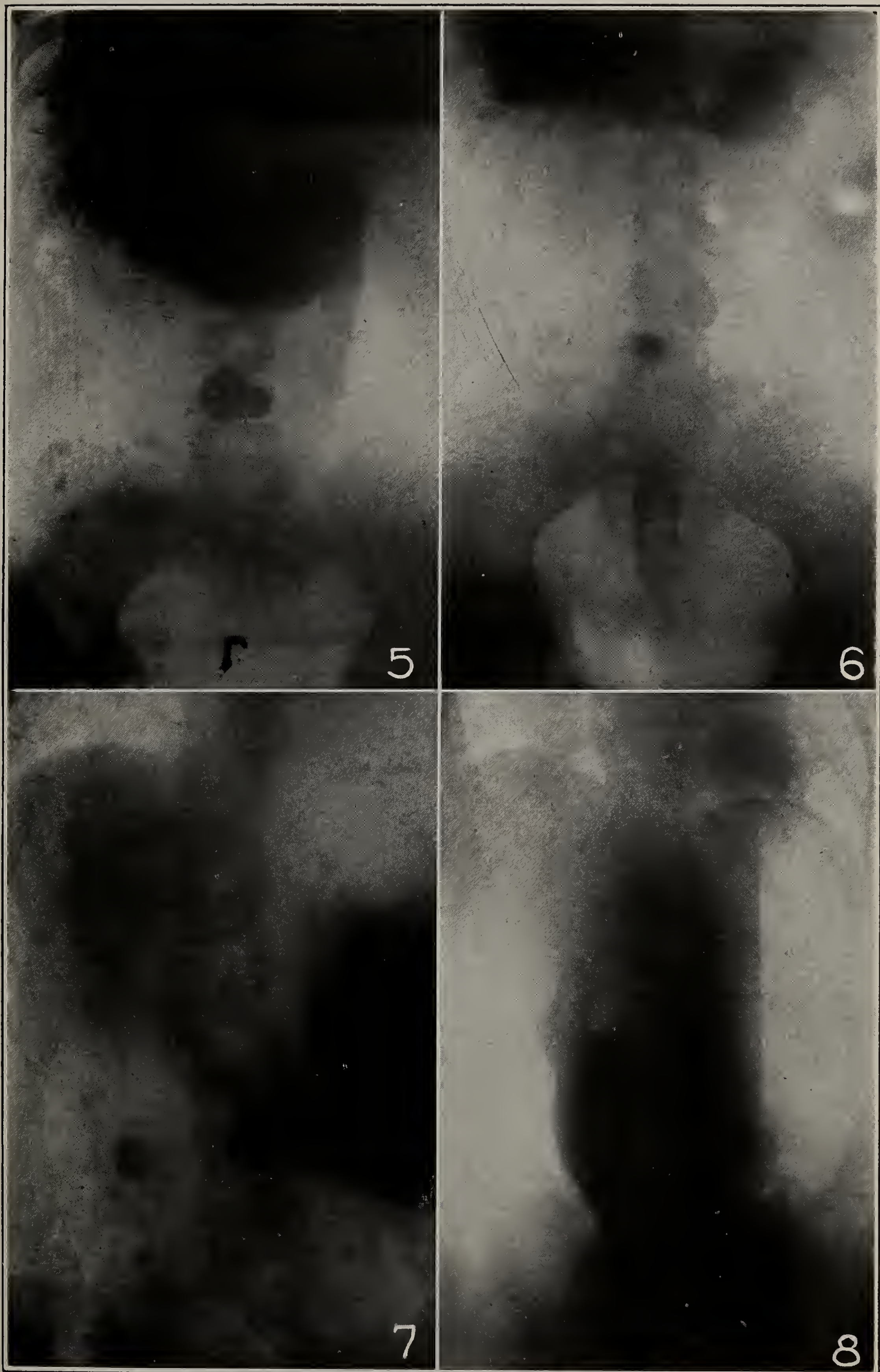
Dorso-ventral view of the preceeding stomach with the patient on the right side, taken directly after No. 1. Gravity has carried the tube across the spine so that it enters the cardia at the right edge of the spine instead of at the left as in No. 1. Most of the bismuth has

gravitated into the pyloric end, which is well distended, and presents at its upper part an irregularly indented outline.

Dorso-ventral view, patient on the right side. Immediately after lavage and introduction through tube of 3 drachms of bismuth subnitrate in 8 ounces of water the day before negatives No. 1 and 2 were taken. The tube enters cardia at the *right* edge of the spine, crosses the fundus obliquely downward to the left and turns sharply upward at the greater curvature. The pyloric end is filled with the mixture, the bismuth below and the upper level of the fluid indicated by a straight line. Corpus and fundus are filled with gas. Passing the tube into the stomach it had been noticed that it did not go down as it should. Partial withdrawal and reinsertion of it gave the same feeling of resistance. The day before orthodiascopy had revealed a magenblase which permitted a small bismuth and water mixture to settle upon its bottom without the latter showing much disposition to let it pass through in spite of prolonged and repeated pressure upon the abdomen and counterpressure against the back. Deep breathing finally causes some of it to escape through a finger-like process into the depths of the belly below. (No. 2.)

The history of the case, together with existing signs and symptoms, admitting no doubt of the presence of a non-palpable cancer which involved the stomach, the bismuth mixture persistently refusing to pass beyond the blase and the tube meeting with a decided obstruction after it had entered the stomach, the diagnosis of hourglass malignant contraction would have seemed reasonable had not the further examination by means of the full bismuth meal as illustrated by these negatives disproved this theory and explained the misleading data, while at the same time it pointed to the pylorus as the cause of the enormous dilation and the seat of the growth. Gastro-enterostomy, followed next day by a post-mortem examination, proved the entire correctness of this view, and emphasized the importance of not mistaking the bottom of the blase for an organic stricture.

Patient a young man, on right side. Dorso-ventral exposure. Gas occupies upper (left) part, bismuth the lower (right or pyloric) end. Notice spleen and left kidney, whose upper border was palpable. Right diaphragm considerably higher than left.



To Illustrate the Presidents Address

Same patient on his belly. Presence of some food prevents the bismuth from reaching quite to the bottom of the stomach. Lowest point of lesser curvature opposite second lumbar vertebra. The orthodiagraph showed the lowest point of greater curvature one handbreadth below the navel. (No. 3.)

Same patient on his back. Ventro-dorsal exposure. The fundus being lowered in this position, gravity serves to fill it out with bismuth.

A girl, chlorotic, aet. 13, on her belly. Dorso-ventral exposure. Notice the sphincter of the antrum, the antrum itself filled with bismuth, with the pylorus and a part of the duodenum below. Caudal pole above the navel. Orthodiagraphy, the patient standing, located caudal pole three finger-breadths below the navel. (No. 4.)

Same patient on her back. Dorso-ventral exposure. Fundus better filled with bismuth than with patient on her belly. Part of duodenum clearly shown. Notice that the caudal pole is considerably higher than in standing position. (No. 5.)

Girl, aet. 20, on her back. Head end of table tilted down about 15 degrees. Ventro-dorsal exposure, immediately after eating two ounces of bismuth in twelve ounces of milk, and then drinking four ounces of milk without bismuth. Caudal pole at pyloric end opposite disc between 12th dorsal and 1st lumbar vertebra. Fundus well filled with bismuth, which is already appearing in small intestines. Upper end of pyloric portion on a level with lower part of 11th dorsal vertebra. (No. 6.)

Same patient on the belly. Dorso-ventral exposure. Notice the spleen influencing contour of greater curvature by pressure against its upper portion. Caudal pole on a level with the navel. In the standing position the caudal pole reached about one-half inch lower than in prone, as ascertained by orthodiagraph.

Girl, aet. 22, on the belly. Dorso-ventral exposure. Stomach vertical and sharply bent at caudal pole like the heel of a stocking at level of navel. (No. 7.)

Same patient standing. Same exposure. Caudal pole six finger breadths below the navel.

Same patient on the right side, dorso-ventral exposure. Right diaphragm higher than the left; heart dropped toward the right. Caudal pole of stomach lower than in prone, but higher than in standing position. Entire lesser curvature well marked. Sphincter of an-

trum and antrum well filled with mixture. Level of fluid well defined. (No. 8.)

A girl, Aet. 25, on right side. Dorso-ventral exposure. Upper level of fluid shown in this position by a straight line. Right diaphragm higher than left. Notice effect of peristalsis on pyloric portion.

Same patient, same position, same exposure. Notice bulging of lesser curvature by weight of bismuth. Pyloric portion differs in shape from preceeding from absence of peristaltic wave. (No. 9.)

Same patient on the belly. Dorso-ventral exposure. Stomach still drawn over to the right from lying on the right side during the two previous exposures. Caudal pole on a level with the crest of the ilium. (No. 10.)

Same patient standing. Dorso-ventral exposure. Caudal pole three finger breadths above symphysis pubis; i. e., six finger breadths lower than in horizontal position.

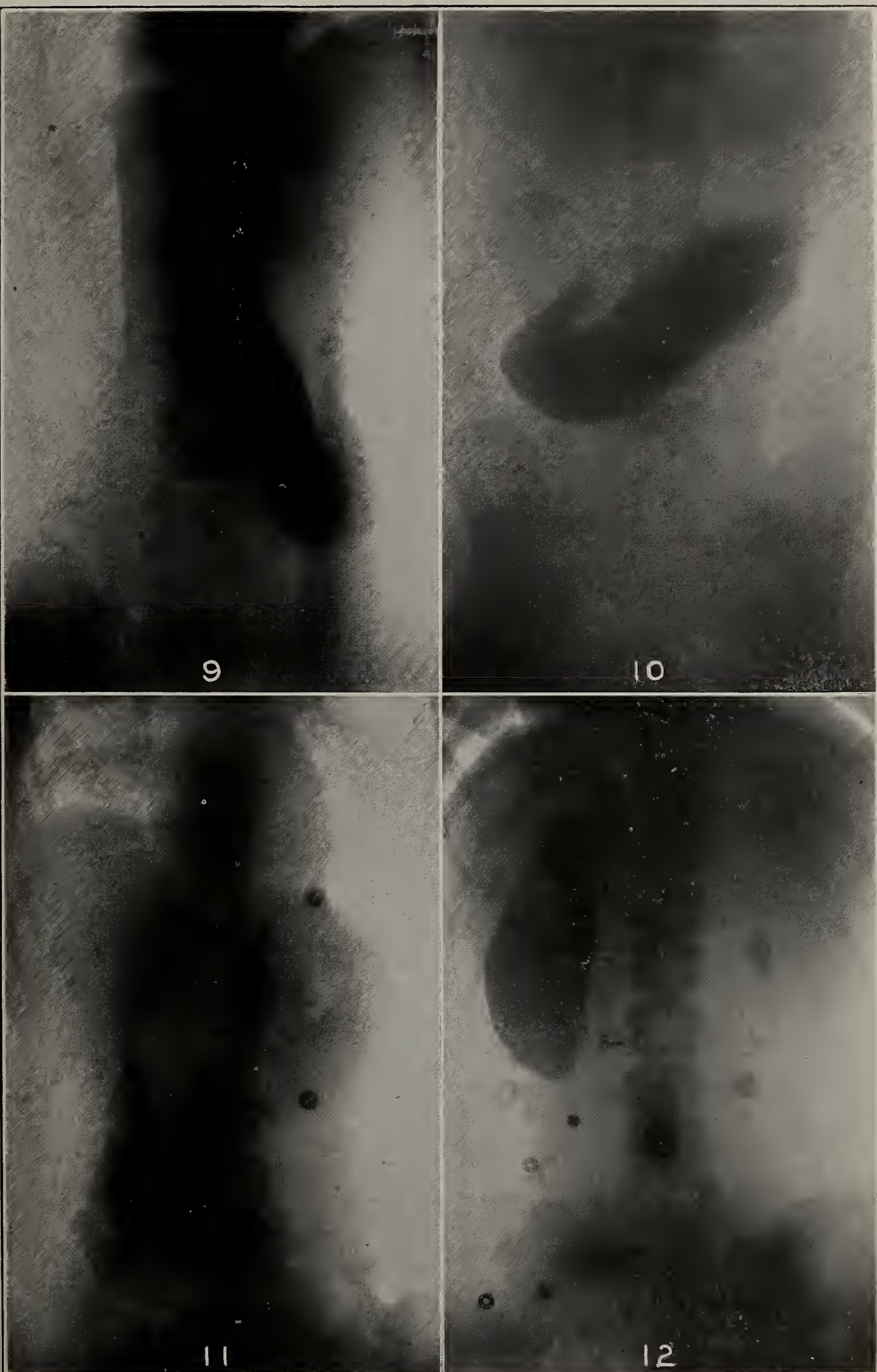
Same patient, same position, same exposure. Notice the hand pressing against the lower abdomen and the effect of pressure upon location and shape of lower segment of the stomach. (What would be the effect, according to the testimony of this negative of a good support and skillful massage?)

Patient female, Aet. 35, on her right side. Dorso-ventral exposure. Lesser curvature clearly shown and bent sharply at pyloric end. Blase small, antrum filled with bismuth. Standing, the caudal pole came down to four finger breadths below the navel. (No. 11.)

Patient a girl, Aet. 14, lying on the belly. Dorso-ventral exposure. Notice the unusual shape of this stomach, with its screw-like twist and seeming break through its middle from peristalsis. Its caudal pole is on a level with lower border of the 5th lumbar vertebra. Standing, it comes down (orthodiagraphic examination) to four finger breadths below the navel.

Same patient on her back. Ventro-dorsal exposure. The stomach is somewhat higher than in No. 1. Though only a few minutes have passed since she took the meal, bismuth shows in the small intestines. (No. 12.)

Same patient on her right side. Dorso-ventral exposure. Notice that again this position seems to give us the entire contour of the greater and lesser curvatures, the pyloric portion, sphincter of the antrum, and location of pylorus. The right diaphragm is higher than the left, and the heart is displaced toward the right. (13.)



To Illustrate the Presidents Address

Patient, a girl, Aet. about 28, on her belly. Dorso-ventral exposure. General direction of the stomach is downward and to the left. Caudal pole is on a level with the 5th lumbar vertebra. (No. 14.)

Same patient on her back. Ventro-dorsal exposure. Fundus contains more mixture than with patient on her belly, and caudal pole is still more to the left. (No. 15.)

Same patient on her left side. Dorso-ventral exposure. Shape of stomach in this position is most extraordinary and resembles an almost straight piece of sausage of small cross section. The left diaphragm is higher than the right. Heart is displaced toward the left. (16.)

Same patient on her right side. Dorso-ventral exposure. The right diaphragm is now higher than the left. Heart displaced toward the right. Caudal pole very low for this position. Entire lower curvature covered with bismuth. Supernatant fluid sharply defined above the horizontal line. Gas above the level of the fluid reveals the greater curvature. The contour of the entire stomach, which is much dilated, is shown in this position. (17.)

Same patient standing. Dorso-ventral exposure. Caudal pole three finger breadths above symphysis pubis. Magenblase spindle shaped. (No. 18.)

Same patient, same position and exposure, but taken five days later immediately after another bismuth meal. The colon shows up well by means of the previous mixture, still in evidence. The hand that presses the stomach upward, at the same time presses the transverse colon downward into the pelvis. No. 19.)

A cursory view of the negatives we have gone over rapidly thus far should convince us that an examination for gastroptosis—not to mention enteroptosis—limited to a dorso-ventral exposure of the patient lying horizontally upon his belly, by preventing the elongation of the stomach toward the pylorus, actually accomplishes the very opposite of the purpose for which the examination is undertaken. It does not reveal the degree of ptosis present. It conceals it. It corrects it. A ventro-dorsal exposure with the patient flat on his back is even less suitable for this purpose. Gravity permitting the stomach to fall toward the fundus (its lower part horizontally) this position corrects the existing deformity still further. To emphasize this point I will show two other negatives. They are selected from a series which I made for Dr. Richard Smith to illustrate his work on Enteroptosis, read before the American Gynecological Society

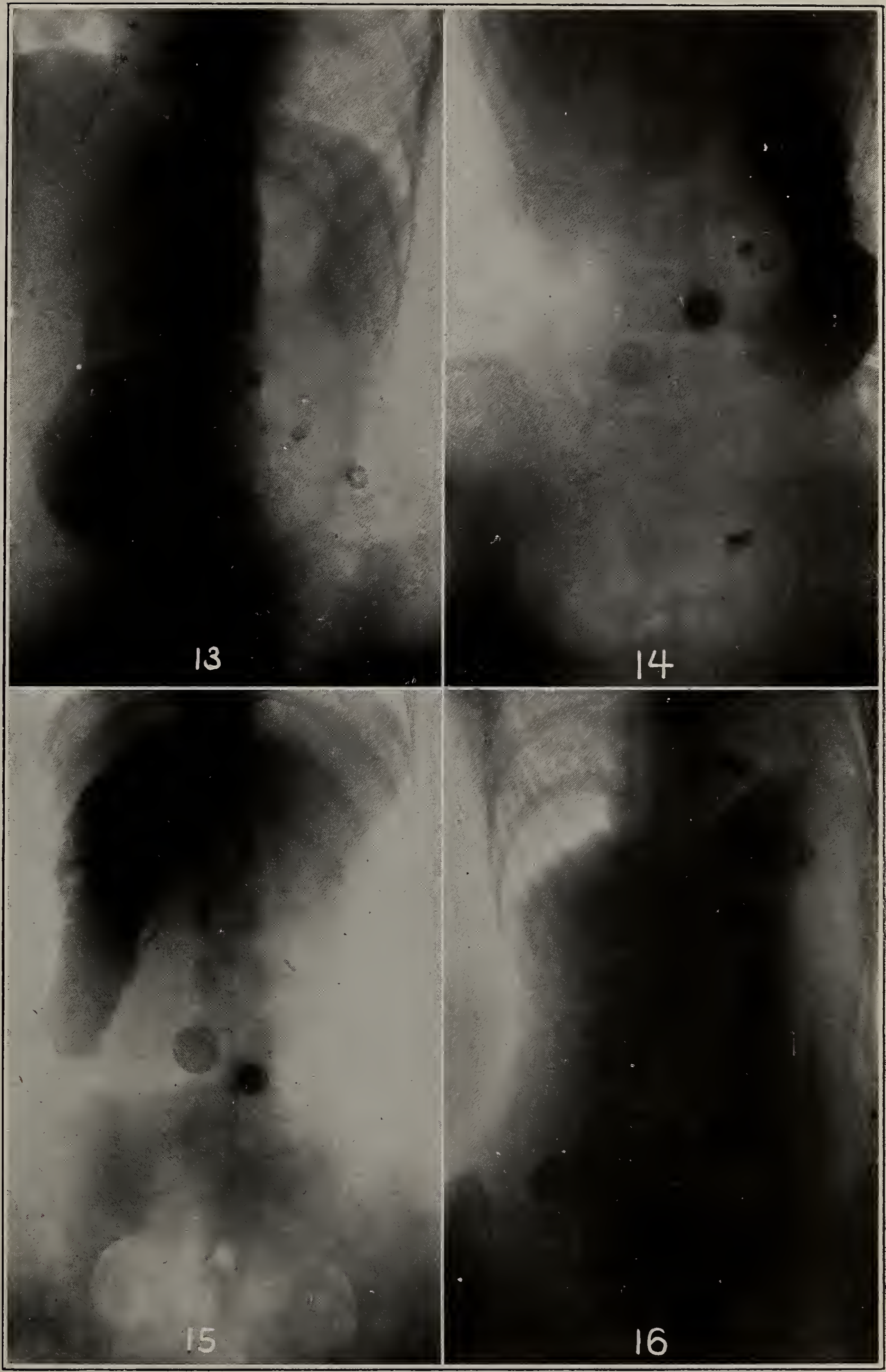
at Hot Springs in May of this year. I am indebted to his kindness for their use to-day.

Nullipara Aet. 24, horizontal on the belly. Exposure dorso-ventral. Caudal pole three finger breadths below the navel. Some of the rugae in the fundus brought out by a slight deposit of bismuth.

Same patient standing. Dorso-ventral exposure 6 hours after the meal. Motor insufficiency indicated by the presence of bismuth still in lower segment and antrum. Caecum and ascending colon filling. In this position the stomach, though almost empty, reaches two inches lower than it did in the prone position when filled.

You may imagine my astonishment the other day when a colleague insisted nevertheless that the prone position is the best and only correct one for determining the position of the normal and abnormal stomach, because "originally man went on all fours." Originally, for aught we know, we may have only swelled the nebular hypothesis, but now that we are no longer in the position of a comet's tail, nor that of an amoeba reaching after our pabulum with pseudopods to satisfy our longing for benevolent assimilation, nor that of quadrupeds whose females were adorned with sixteen breasts, as Dr. Stratz assures us in "Die Schoenheit des Weibes," but have developed into enlightened bipeds blessed with a stomach suited to our high estate, now, to speak with the Doctor in Moliere, "we have changed all that."

Thus far we have said nothing about the examination of the stomach six hours after the bismuth meal to ascertain its motor efficiency, nor about the intestines and the colon, so difficult to locate by ordinary methods of percussion, and transillumination, and, partly for that reason offering a rich field of research to the Roentgenologist, first because we have not the time, and second, because diascopy has added nothing to our knowledge beyond that already furnished by Roentgenography. Aside from this, the steps of the method thus rapidly reviewed (and illustrated by ordinary Roentgenographs) by no means exhaust the possibilities of abdominal orthodiascopy. The probable nature of each case as indicated by its history, laboratory findings, and clinical signs and symptoms, should determine the particular plan of examination to be adopted. Not infrequently the easy method first described will admirably serve our purpose. For a more extended search we may choose to reject the shorter method and select the longer one, or combine both.



To Illustrate the Presidents Address

Inflation may reveal a tumor. To bring out the lesser curvature and pyloric end in stenosis or suspected cancer, the horizontal position with the patient on his right side is probably the most valuable of all.

We find, then, to state the matter briefly, that though a Roentgenograph is much superior in quality to anything seen on the fluoroscopic screen, fluoroscopy, especially orthodiascopy, deserves a place in the examination of the stomach. For the simple purpose of locating accurately and beyond a doubt, its cephalic and caudal poles it is quite sufficient.

In fact, for this purpose, it is much better than the ordinary Roentgenograph, which needs to be interpreted according to the law of projection. For the study of motion the passage of the capsules or mixture down the oesophagus, into the magenblase and thence to the bottom of the stomach, for measuring the effect of inspiration (which is greater upon the upper than the lower pole of the stomach) or that of voluntary contraction of the abdominal walls (which affects the caudal pole more than it does the diaphragm), the advantages of the screen are apparent. And when we add to this the ease with which the filling and distended stomach can ve viewed from every direction, the patient tilted with his head downward or in the horizontal or erect position, the advantages of diascopy over the slow and laborious photographic process become for certain purposes more striking still. To discard the latter altogether, however, except for purposes of teaching and illustration, as Holzknecht would have us do, is to be content with half instead of the whole. What we want is not merely Roentgenography or Roentgenoscopy, but Roentgenology.

A year ago I refrained from generalizing on the thirty cases I had then examined, and although the number has more than doubled since then, I still feel no vocation that way. The gastro-enterologist, not the Roentgenologist, should take up the physiology, pathology, and topographical anatomy of the stomach and intestines, and go over the field again by the light of this invaluable method; meanwhile a few remarks may not be out of place.

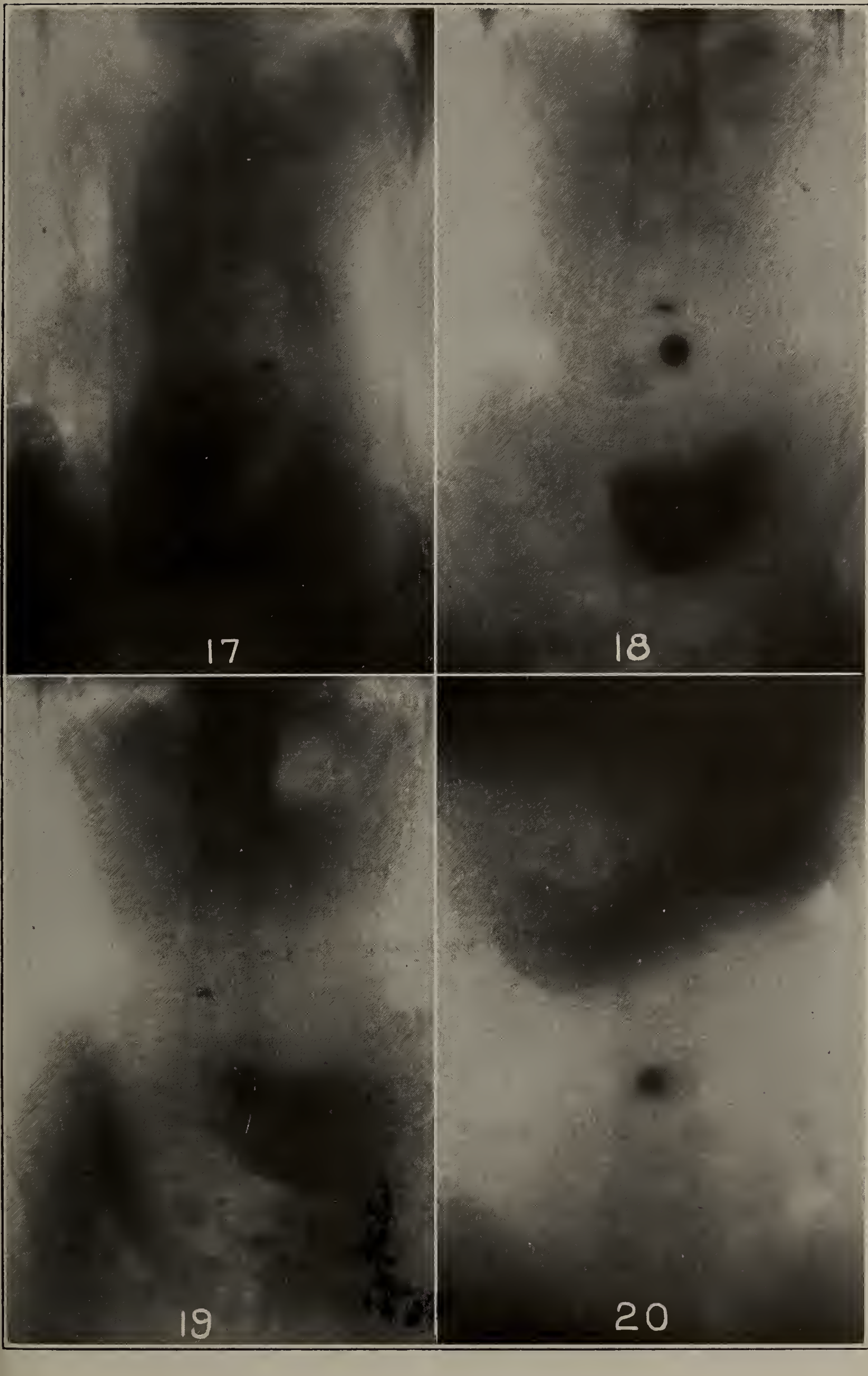
"Stomachs, like noses, may vary considerably in size and yet be within normal limits, but when they extend in the empty condition, much lower than a point midway between the sternum and umbilcus, they are generally pathologic," says Reed. As great a diagnostician

as Boas admits, however, that the lower border of the empty stomach is not located with any degree of certainty. Reed's normal stomach retires, therefore, into the limbus of obscurity where no one (except a Roentgenologist) is likely to find it. The negatives we have just gone over have demonstrated that the prone position, especially with the patient on his back, is faulty, as it fails not only to bring to light the existing ptosis, but actually obscures it, corrects it. And yet it is safe to say that most examinations are still conducted in this way. No wonder Holzknecht asserts that "clinical literature is unacquainted with the normal stomach." At any rate, such pictures of it as you see in books on diagnosis you will probably never obtain from living subjects by means of the Roentgen rays.

Again, authors by no means mean the same thing by the word normal and abnormal. Thus the statistically most common stomach, the stomach which is in the majority, so to speak, is referred to by some as normal; others, like Reed, for instance, in the passage quoted, seem to mean by it a stomach which gives the owner no trouble.

Unfortunately for the theory, trouble does not always show itself in its seat of causation, so that we are not always sure whether an organ causes trouble or not. We find people with the stomach and colon in various positions, who nevertheless present no symptoms prima facie referable to this organ. Statistics will not help us to find out what is normal. We must get at it some other way, and carefully avoid all dogmatism. Now it is a significant fact that a relation exists between the general conformation of the body and the position of these organs. Becker and Lenhoff divide the jugulo-public distance by the waist measure, and multiply by one hundred. If the result is greater than 77, the right kidney will presumably be found palpable. This is probably not quite correct, but it is at least a recognition of the general fact that the habitus phthisicus is the habitus enteroptoticus as well. To both belong the sharp epi-gastric angle, slanting ribs, narrow lower thoracic aperture or paralytic thorax, and vanishing lumbar curve calling for the compensating bustle, as Mathes points out.

Now we find that stomachs of people built that way differ only in degree from a certain type unfortunately but rarely encountered in women at least, and then only



To Illustrate the Presidents Address

in such as approach most nearly the standards of classic beauty.

This type of stomach is presented by Case No. iv., as reported by me in The Physician and Surgeon of Sept., 1905, and described as "horn-shaped." Case No. xiii. of the same article, though one of transposition of all the viscera, is a second instance, and was described as "comma-shaped, larger end upward." Later Holzknecht by a curious coincidence, found the same resemblance of this type of stomach to a slightly curved cow horn. This type of stomach has one peculiarity in which it differs from all others; it descends but very little, if at all, upon assuming the erect position.

Stomachs that never look twice alike do not belong to this class; variability of form and position characterizes the stomach of the enteroptotic habit. On the contrary, the type of stomach which we now accept as normal is always in the same place, and is of the same shape. It is not vertical; it's caudal pole is well above the navel and represents the pyloris. It extends obliquely downward and is unlike anything seen in Buttler, Musser or Sahli. The nearest approach to such a normal stomach in a woman, among the negatives presented by me to-day are those of Series vi. There was but one and one-half inches difference in the position of the lowest point of the greater curvature in the prone, and in the erect position, and her stomach corresponded in this with her figure, which was one of the best I have ever examined. Mens sana in corpero sano. Furthermore, we may expect a normal stomach in a perfect body.

We may generously concede that a saint may be enteroptotic and still be a saint, though insisting that the true, the beautiful and the good are one as well as three. We draw the line, however, at enteroptotic Apollos, and gastroptotic Venuses. Present me a Venus and I will demonstrate to you a comma, or cowhorn-shaped stomach, whose lowest point is at the pyloris.

Last Friday after finishing these sentences, two sisters were brought to me for examination. Both were beautiful. E. Aet. 17, measured 5 ft. 2 inches in height, bust measure 33 inches, waist measure 26 inches, jugulopubis distance 21½ inches. N. Aet. 15, height 5 ft. 2 inches, and eight times the length of the head; waist measure 27 inches, circumference of bust over nipples 36 inches, jugulo-pubis distance 21½ inches. The latter

is the most perfect figure I have found, and the former is not much inferior.

I wish to show you the negatives I obtained, one of each, in the prone horizontal position, dorso-ventral exposure. Unfortunately these were the only plates I had left, and were no longer fresh. (No. 20.)

E's stomach reached to one finger breadth below the navel in the standing position; N's to three finger breadths above the navel. In the dorso-ventral position, as these pictures demonstrate, E's was three inches, and N's but one inch higher. Both stomachs, but especially that of N, who possesses the better figure of the two, are typically cow-horn shaped, or comma shaped, its point corresponding to the pyloris being lowest.

Not aiming at an exhaustive discussion of the subject, I purposed to place before you this further development of the work I presented one year ago. Instead of speaking after the manner of presidents, I chose to address you as a fellow, and while I thank you as such for your attention, I conclude by thanking you also for the pleasure and the honor of the presidency of the American Roentgen Ray Society.

BIBLIOGRAPHY.

H. Rieder: Beitraege z Topographie des Magendarm-Kanales beim lebenden Mensehen, etc.; Fortschritte a. d. Geb. d. Roentgenstrahlen. B. 8, H. 3.

H. Hulst: Roentgenography in diseases of stomach and intestines; Transactions of the American Roentgen Ray Society, 1905 (published in 1906).

Guido Holzknecht: Mitteilungen aus d. Laboratorium f. radiologische Diagnostik and Therapie—B. 1. H. 1.

Richard R. Smith, Enteroptosis, Surgery, Gynecology and Obstetrics, V. 111, No. 1.

Reed: Diseases of the stomach and intestines.

Boas: Magenkrankheiten.

Mathes: Ueber Enteroptose, nebst Bemerkungen Ueber die Druckverhaeltnisse im Abdomen. Arch f. Gynaecol B. LXXVII. H. 2.

*THE X-RAY DIAGNOSIS OF RENAL CALCULI.

FREDERICK H. BAETJER, M. D., Baltimore, Md.

In presenting this paper to the society I realize that my subject to a certain extent is an old and hackneyed one. My connection, however, with the Johns Hopkins Hospital has afforded me such an unusual amount of material and some of it at the same time so interesting that I thought it might be of interest to the society to hear of our results. We can safelv say that since the advent of the X-ray, the diagnosis of renal calculi has become almost a certainty. We still meet medical men, however, who have no faith in the diagnosis of calculi by means of the X-ray. This attitude of mind can be attributed to two causes, the disappointing results arising from carelessly taken skiagraphs and the dread of X-ray dermatitis. The popular opinion still prevails among the medical profession that the diagnosis is merely a case of photographing the kidneys. Shenton says, "Such an examination is not merely photographing a patient's kidneys, a foolish and prevalent expression, prevalent because of want of knowledge generally among the profession of the things pertaining to the rays, foolish because it is rare in the skiagraph of the abdomen to see the kidneys, for, as a rule, the less that is seen of the kidneys the more chance there will be of seeing the calculus." Examination by the radiographic method is the one most generally employed, though one well known skiagrapher maintains that the fluoroscopic method is the more accurate and delicate. He says, "One might draw a parallel between the faint shadows seen upon the screen and the faint sounds heard in a stethoscope. To the untrained eye or ear neither have significance, yet it is possible that a careful study of the ghostly screen effects may lead to a more delicate and perfect method of ascertaining the conditions of the abdominal organs . . . . . However this may be, the search for calculi is an established and comparatively simple process."

Fenwick suggests the examination of the kidney at operation. His method is to bring the kidney out of the incision and then examine it fluoroscopically. This method,

Read by invitation before the 7th Annual meeting of the American Roentgen Ray Society at Niagara Falls, N. Y., August 29 to 31, 1906.

however, as he points out, would not always be possible, as in some patients the blood vessels are too short to permit it.

We use the radiographic method entirely. The procedure employed is briefly as follows: Before examination the patient's bowels should be well evacuated. He is then placed in the dorsal position, legs slightly flexed so the back approximates the table. All clothing both upon the back and abdomen is removed to avoid the possibility of a shadow of some extraneous object (a button) being mistaken for a calculus. The plate is placed beneath the back, its upper margin reaching the eleventh rib and the lower border, the ileum. An 11x14 inch plate is used, as its size is sufficient to cover both kidney regions, and as it sometimes happens that calculi are found on the side opposite to that in which the pain is felt.

The tube is placed directly in front of the patient in the median line just above the umbilicus and from ten to fourteen inches from the abdominal wall. If the radiograph is good the twelfth rib, the transverse processes of the vertebrae, the crests of the ilia and the psoas muscles are readily seen. With such data one has, as a rule, sufficient differentiation to determine the presence or absence of a calculus either in the kidney or upper portion of the ureter.

A second exposure should be made. This time the upper margin of the plate reaching the crests of the ilia and the lower margin being well below the trochanters. The tube is placed in the median line, but this time half way between the symphysis and umbilicus. In this position the rays fall in the line of the pelvic canal and thus the possibility of having the ureters projected upon the sacrum is avoided.

This second plate gives that portion of the ureters lying within the pelvis. With a renal calculus the most common situation is in the angle formed by the last rib and the spinal column. A light shadow with rather a definite border in this situation should always be viewed with suspicion. Occasionally such a shadow will be found midway between the tip of the last rib and the crest of the ileum. In such cases if a stone, the abnormal position is due to a misplaced kidney. Any suggestive shadows lying external to the twelfth rib may generally be disregarded, as they are too far out to be in the kidney. If, however, we have a very large kidney distended with calculi, then the shadows will extend beyond the twelfth rib. In the vast majority of cases such shadows, however, are generally

due to some shadow casting substance in the intestine.

While theoretically calculi may be found anywhere in the ureter practically, they rarely occur except in the lower two inches of its course. The presence or absence of these stones is determined by the radiograph of the pelvis.

A line drawn from a point one-half an inch internal to the pubic spine to the sacro-iliac articulation roughly gives the position of the ureter. A light shadow occurring in this line may be regarded as a calculus. Care must be taken, however, not to confuse such a shadow with one cast by a phlebolith. This region is richly supplied with veins and it is quite common for phleboliths to form in them. The shadows cast by these concretions, however, are more definite and their edges are more sharply defined. Then, too, they are smaller, rarely exceeding 3mm. in diameter.

Since the conditions which lead to the formation of phleboliths are usually present in all the veins in this region, these concretions are apt to be multiple. Where the diagnosis is in doubt between the two conditions, the presence of one or more similar shadows elsewhere would indicate the shadow to be that of a phlebolith. In some of the doubtful cases the diagnosis may be settled by the ureteral catheter, though in one case in the records of the Johns Hopkins Hospital a small stone lay in a pouch in the ureteral orifice. A catheter could be introduced with ease, passing over the stone.

Recently a soft flexible catheter with some shadow casting salt incorporated in its substance has been devised by Fenwick. This is introduced and the radiograph is made. If the suspicious shadow is a stone it will be in the line of the catheter, but if it is a phlebolith it will be external to the catheter.

Occasionally a calculus may occur in some other portion of the ureter. In such cases it will show as a light shadow about two inches from the vertebral column. In three only of 351 cases examined for calculi were they found above the brim of the pelvis.

Thus far, the chemical composition of the stone has not been considered. Since the sharpness of the shadow depends upon the density of the object radiographed, naturally those can be represented best which consist of inorganic matter, that is, a mineral substance such as the salts of calcium. Those made up largely of organic matter cannot be so easily radiographed.

Calculi may be roughtly divided into oxalates, phosphates and urates. If a specimen of each class is placed upon a photographic plate and a radiograph made, one finds that the oxalate casts a dense shadow, the phosphate, being more permeable to the rays, casts an indistinct shadow, and the translucent urates scarcely any. Thus success or failure is somewhat dependent upon the chemical composition and, consequently, upon their opacity to the rays.

In the earlier days of this method of examination the detection of pure uric acid calculi was uncertain and difficult. A few years ago Albers Schönberg devised an apparatus by means of which we could not only compress the abdomen, but also cut out all secondary rays and thus do away with the fogging of the skiagraph. With the aid of such a device skiagraphs are obtained so rich in contrast and detail that even these calculi can be detected. The beautiful work of Albers Schönberg and others furnish striking examples of this fact. Our experience with the compression diaphragm has been so extremely good that we would not be without it. Whereas it is valuable in all kinds of radiographic work, it is of most value in kidney work. Repeatedly in large subjects we have succeeded in getting the shadow of a stone which could not be obtained by using the ordinary method. In the last two years it has been used practically in all cases of suspected calculi.

While it is true the percentage of failures is becoming smaller each year, it is unlikely that absolute accuracy will ever be obtained in this as in any other method of diagnosis. Mistakes in diagnoses fall under two heads; first, those cases where calculi were found at operation, but not by X-ray, and secondly, where the ray found calculi, but diagnosis was not confirmed at operation.

Many failures result from carelessly taken skiagraphs. Detection of calculi is by no means easy, and accuracy can only be obtained by careful work and long experience.

The chemical composition has already been mentioned and one can readily see that a small uric acid calculus might not cast a shadow. The size is an important factor. A calculus, the diameter of which is less than one-half cm. may easily remain undetected.

Though the stone itself may be of such size and chemical composition that one would expect its detection an easy matter, the physical condition of the patient may interfere considerably with the diagnosis. Since the detection depends upon the differentiation of the shadow of the

calculus from that of the tissues, it naturally follows that the greater amount of substance the ray has to penetrate before reaching the calculus, the less contrast there will be between it and the surrounding tissues, consequently in very fat individuals a small calculus may be easily overlooked. Intestines filled with fecal material may so obscure the renal and ureteral regions as to make it impossible to locate the stone. In this connection it is well to emphasize the point of always having the patient's bowels well evacuated before making the examination.

Those cases in which the ray found a stone but the surgeon found none are not so frequent. It may happen that during the operation the manipulation of the kidney dislodges the calculus and causes it to change its position. This is well illustrated in a case which came under my observation. A small calculus was found in the kidney by the ray. During the operation the surgeon experienced great difficulty in freeing the kidney and consequently the organ was extensively manipulated. Upon opening the kidney no calculus was found. The symptoms persisted after operation and a second skiagraph was made. This time no calculus was found in the kidney, but one was shown in the ureter just above the brim of the pelvis. Soon after the patient was seized with another attack of renal colic and in a short time passed a small stone that corresponded in size and shape to the one found first in the kidney and later in the ureter.

The salts of heavy metals, such as bismuth subnitrate, cast quite dense shadows. One case has been reported in which a patient had been taking large doses of bismuth subnitrate. During the administration of the drug, a skiagraph was made and a diagnosis of renal calculus was made from a suspicious shadow in the kidney region. The patient was not operated upon and some weeks later, when a second examination was made, no calculus was found. In this case the subnitrate in the intestines evidently cast the shadow which was taken for that of a stone.

A purulent exudate in the pelvis of the kidney when inspissated and containing deposits of calcium salts, may cast a shadow indistinguishable from that of a stone.

A patient was admitted to the wards of the Johns Hopkins Hospital with the diagnosis of renal calculus. The skiagraph showed a large, well-defined shadow in the left kidney about 3cm. in diameter. At operation upon exploring the kidney pus was found encapsulated by fibrinous tissue lined with a thin layer of calcium salts.

Suspicious shadows simulating those of calculi may be caused by dense cicatrices in the kidney. This is well illustrated by the following case. The patient had had a severe infection of the kidney and subsequently passed several small stones. Two years later he had attacks of renal colic and a skiagraph was made. In the kidney on the affected side three distinct and well defined shadows could be seen. With the history of having passed calculi, diagnosis of renal stone was made. At operation, however, no calculi were found, but a small contracted kidney and in it were masses of dense cicatricial tissue which had cast the misleading shadows.

The question naturally arises: In what percentage of cases does the use of the X-ray enable one to arrive at a positive diagnosis of the presence or absence of calculi? This varies. Some radiographers maintain that an absolute diagnosis, either positive or negative, can always be made; others say that the diagnosis is very uncertain. The personal equation enters so largely into the question that an absolute standard cannot be fixed.

From the series of cases examined at the Johns Hopkins Hospital certain data may be cited which indicate the value of this method. In this series of cases there were some in which the skiagraph showed calculi to be present where the clinical signs did not more than suggest the possibility of this condition. There were those in which the patient had had no symptoms that in the least suggested calculus and the examination had been accidental.

There was still another class, and the most interesting, in which the symptoms pointed so strongly to calculi that an X-ray examination was almost deemed unnecessary, yet neither the skiagraph nor the surgeon were able to demonstrate the presence of calculi. This last series of cases to me are the most interesting. I have had over a score of such cases with typical history of renal colic. Practically all gave the history of sudden attacks of violent pain, so intense as to cause nausea, always followed by bloody urine which would clear up in a day or two. The X-ray findings were absolutely negative and a number of the cases when explored showed an absolutely normal kidney and ureter. The interesting feature in connection with them is that all came from comparatively the same section of the country, namely, the Carolinas.

In the past four years 354 cases have been examined for renal or ureteral stones. In 85 cases calculi were found by the ray, 60 of these were operated upon and the diagnosis confirmed by the surgeon. The remaining 25 for various reasons have not been operated upon.

Of those in which a negative diagnosis was made, 72 were explored and in one case only were calculi found. The remaining 197 cases were not explored and subsequent history seems to confirm the negative diagnosis.

From these figures it will be seen that the positive evidence is absolutely reliable; the negative not entirely so. However, the negative evidence should have weight in absence of symptoms definitely indicating the presence of a stone.

The location of the calculi was as follows: Of the positive cases calculi were found 47 times in the kidney. In two cases only were both kidneys affected.

In six cases the stones were multiple. In two cases they were present both in the kidney and ureter.

Of the 38 cases of calculi in the ureter, in three cases only were they above the brim of the pelvis. In the remaining 35 cases they were lying in that portion of the ureter contained in the bladder wall.

The calculi varied in size according to the situation, those in the ureter ranging in size from a small pea to a date seed. In the kidney from one-half cm. to eight cm. in diameter.

In conclusion, it may be said that with good apparatus and technique calculi when present can practically always be found. The X-ray examination gives definite and positive information as to the location, number and size of calculi present. As already pointed out, it shows the position of the calculus whether in the kidney or ureter. This simplifies the operation and the surgeon is less likely to overlook a stone when more than one are present.

An X-ray examination should always be made in suspected cases. This is not dangerous and, furthermore, gives no discomfort to the patient. Indirectly the examinations are of great benefit to the diagnostician, as they enable him to define more sharply the symptoms associated with the presence of calculi and associate characteristic groups of symptoms with its presence he is not now able to connect with the disease. In this way the X-rays will increase the possibility of making clinically a more definite diagnosis of this condition.

DISCUSSION OF DR. BAETJER'S PAPER.

Dr. Charles Lester Leonard, Philadelphia:—I have very little to add to the doctor's paper. I congratulate him on his excellent results. I feel that the work is being widened. I notice it particularly in my own practice. The results are always improved on. Taking my last 150 cases, I doubt that the error is one-half of what it was in the first 200 cases examined, whether in positive or negative diagnoses. In fact, my negative diagnosis has been more accurate than the positive.

The particular thing in which I am interested is the prognosis with reference to treatment; the possibility of calculi passing. Since my last report I have had eight cases where the patients passed the calculi after the diagnosis had been made. This relieves the patient from the necessity of a serious operation and puts him in the position of absolute safety and yet have all the benefits of the best treatment possible.

The differentiation between phlebitis and stone is one of the greatest importance. I think that Dr. Kelly, in his work on the female, has made a step very much in advance in using a ureteral catheter the substance of which is impregnated with bismuth. Of course, the use of the stylet is possible, and it has been used successfully in a number of cases. The flexible catheter is perfectly safe, but when that catheter can be made opaque it is very much better and simpler than to use a stylet.

The differential diagnosis can be facilitated, and always is, where the kidney itself is shown in the picture together with the ureter. Dr. Caldwell showed me some excellent pictures of this kind. I had the misfortune of making a diagnosis of calculus where it was a case of stricture of the ureter with occlusion and gravel above it. The patient was operated on and the real condition was disclosed. Then the surgeon went up to the kidney and found a surgical kidney. He did a nephrectomy. That was a mistake in diagnosis, but operation is always indicated where these shadows are found.

Quite a paper could be written on anomalies found by the X-ray where there was other than stone present, but I am sure that the better definition which we are all getting is making our diagnosis more simple and surer than it has been. If we could all make plates such as Dr. Hulst showed us we would not need a compression diaphragm to make our pictures. I use 12x20 plates. They take in the whole urinary system from the upper pole of the left kidney down to the symphysis pubis. Then you can see both kidneys and their ureters, and by comparison you can make a fairly accurate diagnosis as to the condition present.

Dr. George E. Pfahler, Philadelphia:—I am sure that we all recognize the value of the work done by Dr. Baetjer. I would like to have him tell us how many plates he uses in making an examination of both kidneys, both ureters and the bladder, and how long he exposes in each instance. It is valuable for us to know this so as to perfect our technic for doing this sort of work.

I seldom use compression, although I have a compression tube. I do use a diaphragm, however, and I think it amounts to at least 99 per cent. of the compression diaphragm technic. I use a square diaphragm, one that will just cover an 8x10 plate at a distance of eighteen inches. I usually examine both kidneys, both ureters and the bladder. I use one plate for the kidneys, one for the ureters and another which takes in the bladder. That makes four plates in all. I try to make my exposure during the time the patient holds the

breath, in from five to twenty seconds, so as to avoid the movements of the kidneys caused by the excursion of the diaphragm during respiration.

Dr. George C. Johnston, Pittsburg, Pa:—I would like to call attention to a peculiar condition which I found in a patient about two months ago. A woman, aged 24, a neurasthenic had typical symptoms of stone in the ureter, and such a diagnosis was made by a good genito-urinary surgeon. The urinary findings were positive. At the time she came for examination she was suffering from a typical attack of renal colic, and the surgeon gave her a hypodermic of morphine so as to permit me to make the exposure.

I always use two plates, one superimposed on the other, and on developing them I got a very good picture, and both plates showed a very distinct shadow in the region of the left ureter, about one and a quarter inches above the point of entrance into the bladder. In view of the undoubted character of the symptoms and the brilliancy of the shadow I had no hesitation in pronouncing the case one of stone in the ureter.

The surgeon operated and cut down on the ureter by the extraperitoneal route. Meeting me the next day he expressed himself as being very well pleased, but that if he had known the actual conditions he would not have gone in there. While he found a stone, yet it consisted of a small calcified uterine fibroid which was adherent to the ureter and was compressing its lumen, thus producing a hydronephrosis of the kidney.

Dr. Henry Hulst, Grand Rapids, Mich:—I wish to disclaim the conclusion drawn by Dr. Leonard. A very fine picture of the abdomen will no doubt be sufficient to make a positive or negative diagnosis. It is just as true, however, that in skiagraphy one can improve the technic by using a compression diaphragm, providing it is a good one, and, especially, if the subject is a fat one. In the case of a small spare person it is not necessary to use a compression diaphragm. One can work more rapidly if it is not used, but when you get a patient weighing 230 pounds, you will be very glad to use the compression diaphragm, especially if the stone is a small and a soft one. Pictures will be improved by cutting out the rays which blur them and that is the function of this diaphragm.

Most diaphragms have faults. A fault referred to awhile ago, which, for most purposes, I should consider a virtue, is the small diameter. The smaller the diaphragm, the smaller the opening, the better the picture. By using a diaphragm having an opening two inches in diameter, you will get results you never dreamed of before. Take the fluoroscope and get beneath the apparatus and you will find plenty of rays which you want to cut out. This part of the apparatus wants to be made better. Take a piece of lead as thick as your finger, use a Walter six tube and use a powerful current and the ray will go through all right.

Then make the canopy very large and have it lined with thick lead so that no ray goes around it nor through it. If there is any doubt surround the tube with a good shield besides and cut out every bit of ray.

As to the effert of compression. This is not appreciated as it should be. I was never so much impressed with the effect of it as when I began my orthodiagraphic work of the stomach. As the patient stands up before the fluoroscope you see the organ, and as you compress the patient against the fluoroscope or the fluoroscope against the patient the whole picture changes. Whereas before you may have

had a blur, if you only compress your fluoroscope against the patient your results become different and the stomach stands right out. It is very surprising how a little pressure will produce a great difference in the picture. Pressure with this instrument makes a greater difference still because the pressure is greater and the field smaller.

The pictures I showed you of the stomach I should consider very bad pictures if they were not so large and had been taken with a good instrument of this kind. The spine as it is shown in those 14x17 plates is as good as I can make it without selecting my cases.

The question is how we can do the best possible work at the present stage of our art. I am quite convinced that there is no man who can afford to dispense in work of this kind with any of the accessories at our disposal. A poor compression diaphragm had better be dispensed with. A very fine one will come in handy, especially in the case of fat subjects. In patients of small size it can also be dispensed with, although personally I always use a compression diaphragm in kidneys cases.

I think it is good practice to use a large plate for general orientation, and small ones in the camera for localized examination, and we must not try to do too much at one time. With a kidney case I am willing to spend an hour and a half. Do the very best work you can; take as much time as may be necessary, and charge accordingly.

I never make a diagnosis on a single sitting. If I find a stone, I have the patient wait for a few days or longer, if I have exposed him very much. Of course, if the case is an urgent one you cannot do that. If after having exposed a second time you get the same shadow in the same place, of the same shape, and everything else the same, then make your diagnosis.

Dr. Percy Brown, Boston:—The entire subject of the Roentgen diagnosis of renal calculi is a very complicated one. It seems to require especial care in every step of the procedure. It does not seem to me that enough emphasis has been placed on the preparation of the patient before operation. Usually medical men in my neighborhood are ignorant of the Roentgen method of diagnosis of renal and other calculi, and I do not doubt that this is true in other sections of the country. No doubt many of you have received a request to diagnosticate renal calculus at a moment's notice, without any preparation of the patient whatsoever.

I always request the doctor to give his patient a thorough cleaning out as to the bowels, and then to instruct the patient to partake of a moderate meal beforehand, so that the stomach will be as empty as is possible. By doing this you have accomplished thirty-three and a third per cent. of a good result.

Dr. Baetjer, closing the discussion:—In regard to Dr. Pfahler's question. I use an 11x14 plate, and I make first a general picture of the abdomen as far as the crest of the ilium. Then I make a second plate of the ureter contained in the pelvis. I never rely on the general picture for accurate diagnosis. I make a series of compression pictures so as not to expose the same plate twice.

I find that I get better results by exposing a little longer than most operators do. I rarely make an exposure of this kind in less than three minutes, and when using the compression diaphragm, in five or six minutes. If the patient is very fat, I take more time. In one case I took nine minutes and the radiograph was a very good one.

The distance of the tube will vary, of course.

I agree with what Dr. Brown said. In the hospital I have all

my patients take a brisk cathartic the night before and on the following morning an enema is given. When there is any doubt whether the stone is in the kidney, I have the patient wait for a week or ten days, when I make another exposure. I do not do this because I fear a dermatitis, but I want to make my diagnosis all the more positive.

SKIAGRAPHY OF THE ACCESSORY SINUSES OF THE NOSE.

By E. W. Caldwell, M. D., New York.

The use of the Roentgen ray as an aid to diagnosis in certain diseases of the accessory sinuses of the nose was brought to my attention a little over two years ago by Dr. Coakley, of New York, and Dr. Ard, of Newark. Dr. Ard had just returned from the clinic of Dr. Killion at Freibourg, and had brought with him some excellent plates, in which the outlines of frontal and maxillary sinuses and the ethmoid cells were distinctly shown. On one of these plates there was an increased density of shadow over one of the frontal sinuses, which was believed to indicate pus in the cavity.

There is, in different individuals, such wide variation in the size of the frontal sinuses, in the number and position of their septa; and occasionally such a great lack of symmetry, that the use of the X-ray in this region would be fully justified even if it could give us no other information than the anatomical details just mentioned.

Therefore, at the suggestion of Dr. Coakley, I at once began making radiographs of cases from his clinic at the University and Bellevue Hospital Medical College. To this clinic and to the anatomical department of the college I am indebted for splendid material for a series of experiments which were directed toward securing a good technique for making radiographs of such cases, and for determining their practical utility to the rhinologist.

This work was carried on at the Edward N. Gibbs Memorial X-Ray Laboratory, which is the Roentgen Ray department of the college.

Read by invitation before the 7th Annual meeting of the American Roentgen Ray Society at Niagara Falls, N. Y., August 29 to 31, 1906.

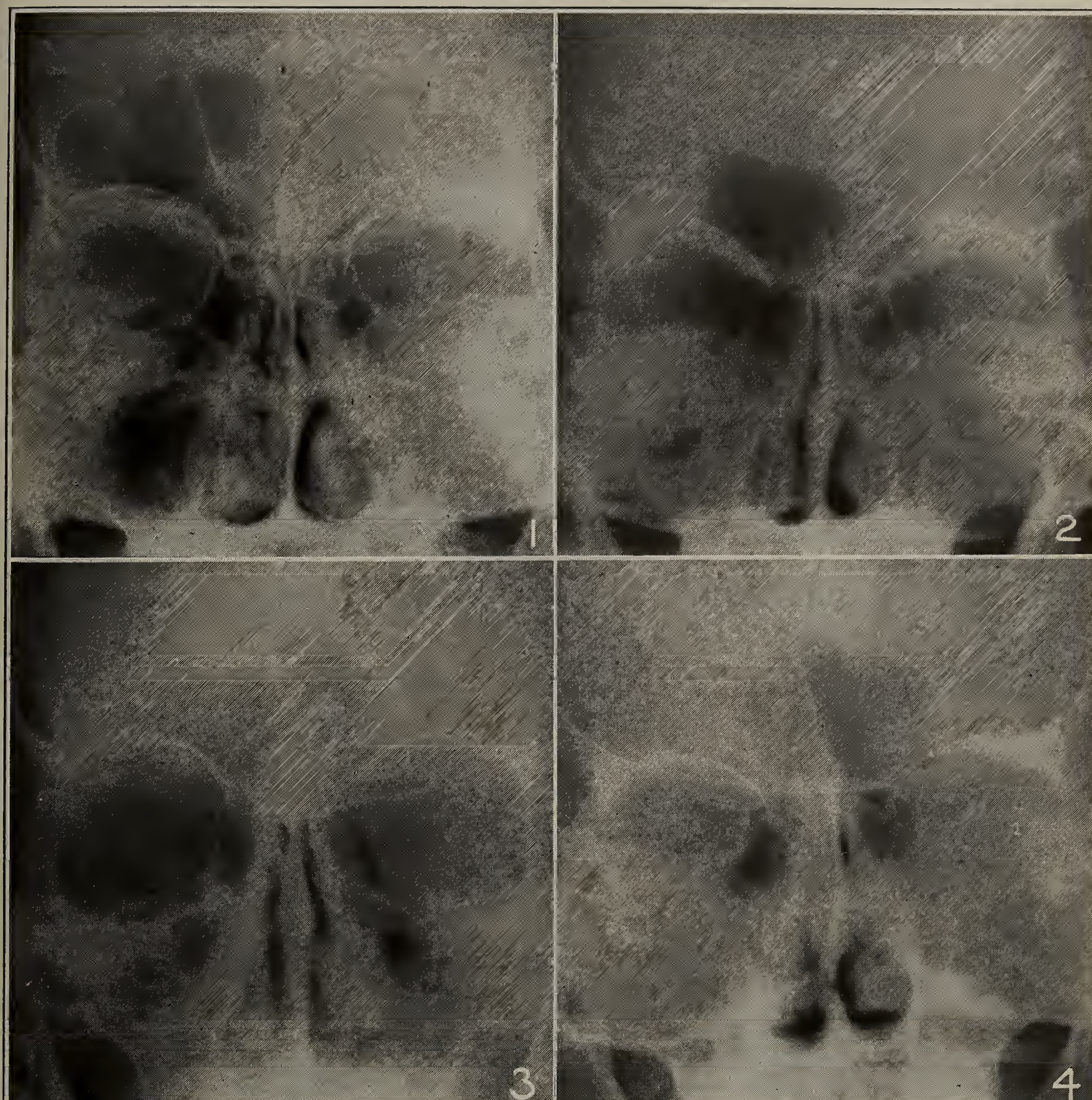
By comparing the frontal sinuses of several cadavers with the radiographs made of them, it was readily shown that the extent of the sinuses, and the location of their septa could be determined by the X-ray with sufficient accuracy for the purpose of the surgeon. The indications given by the X-ray of diseased conditions in the sinuses of patients from the clinic were confirmed in many cases by operation and by other means, but it seemed desirable to make further experiments to determine why the X-ray indicated such conditions, and how much reliance could be placed in these indications. Some experiments with this end in view were therefore carried out by Dr. Chisholm and myself.

It seemed probable that the increased density of the shadows of diseased sinuses was due chiefly to an increase in the amount of fluid in the cavity, either in a swollen and edematous lining membrane or a collection of exudate or pus. Radiographs of specimens of pus and exudates from various sources show that their opacity to X-rays was practically the same as that of a normal saline solution, or of pure water. This was determined by radiographing at the same time equal volumes of the various fluids in little thin celluloid dishes of exactly the same size and shape.

A piece of mucous membrane from a cadaver was cut in half. One piece was kept moist by placing it in a sealed jar while the other piece was dried. The radiograph of the two pieces showed that the water in the moist specimen cast a shadow many times as dense as that cast by the solids of the dry specimen.

We then made radiographs of some heads of cadavers before and after filling parts of the sinus cavities with water or with pieces of moist mucous membrane introduced through trephine openings. It was easy to detect the added liquid and membrane in the radiograph, but the rather large trephine openings were objectionable and it was found very difficult to keep the liquid from leaking out of the cavities. Dr. Coakley then made the very practical suggestion that we use moist gelatin instead of water or membrane for filling the cavities, and the demonstration was then repeated with more refinement in detail. Control radiographs were first made to show that the opacity to X-ray of the moist gelatin was practically the same as that of the water or pus or edematous membrane.

Radiographs of the heads of some fresh cadavers were made. Then the scalp was turned down over the frontal bone until the supraorbital ridges were exposed.



1. Very large frontal sinuses with many septa. Fluid is shown in right frontal and right maxillary sinuses. Operation by Dr. C G. Conkley demonstrated that these cavities were filled with pus.

2. Asymemetrical frontal sinuses. In this case, trans-illumination was misleading. The principal angle is a little too small and the shadows of petrous bones are shown over lower third of orbit.

3. Frontal sinuses rather large, but contain no fluid. The left maxillary sinuses contained small amount of pus The transverse line across upper third of orbits show the limit of shadow of horizontal plate of frontal bone. The principal angle is approximately 25°.

4. Left frontal and both maxillary sinuses filled with pus. Principal angle a little too small for best results.

By means of tracings from the first radiographs, the frontal sinuses and their septa were outlined in ink on the frontal bones of the cadavers. Then by using a small drill, directed downward and backward from points above the superior limit of the sinus, we were able to enter unerringly the different cavities formed by the septa. By means of a small syringe needle introduced through the drill holes, we were able to show that these cavities contained no fluid. We then injected into some of the cavities gelatin which was just warm enough to flow through the syringe needle, and which solidified immediately after. The scalp was then replaced, and more radiographs of the head were made. In these radiographs the empty cavities could be readily distinguished from those filled with gelatin.

These experiments convinced us that the X-ray indication of fluid in the sinuses was fairly reliable,—a fact which had been recognized by our German colleagues before we began our experiments.

In order to use the X-ray successfully for exploring the accessory sinuses of the nose, it is necessary to obtain radiographs of very good quality. Such radiographs are not easy to make. They call for the best possible appliances, and an amount of attention to petty details of technique which the busy clinician is unable, or unwilling to give, and of which he has usually not the vaguest idea.

Owing to the thickness and opacity of the skull and brain, it is necessary to make long exposures, and to use rays of rather high penetration. The use of rays of too high penetration, however, results in a lack of contrast in the negative. Rays of low penetration act more energetically upon the scalp, and longer exposures are necessary with them, in order to obtain sufficient effect upon the photographic plate. Unnecessarily long exposures must be avoided, because they increase the liability of blurred pictures due to movements of the subject, and also because they increase the danger of harmful effects of the rays, both upon the scalp and upon the deeper structures.

The necessity for long exposures, and sometimes for repeated exposure, together with failure to secure the proper degree of penetration and sufficient distance between tube and scalp, sometimes cause X-ray allopecia, and even X-ray dermatitis over the back of the head. Not only these unfortunate accidents, but also the disclosures of Dr. Edsall, of Philadelphia, and others, as to the profound effect of X-rays upon all living cells, remind us of

the importance of working with especial caution and certainty in this region. Indeed, I think it is unwise to expose the same individual during a period of three weeks, for a longer time than is necessary to obtain two or three radiographs in the antero-posterior position.

The danger of X-ray allopecia and dermatitis may be considerably reduced by interposing between the tube and the patient some sort of protective ray filter. For this purpose, I use a sheet of aluminum, 1-50 of an inch thick, very close to the tube, and work with the target of the tube 18 inches from the center of the plate. No accidents have occurred in my practice under these conditions.

It is, of course, necessary to use some screening de- to cut off as much as possible the rays originating from the glass walls of the tube. For this reason, most operators use the Albers-Schonberg compression screen, or some modification of it. These appliances, although exceedingly clumsy, are perhaps the best for the purpose which the market affords.

The usual procedure is to place the patient in a recumbent position, face downward, with his forehead and nose resting upon the plate holder, and to adjust the tubular part of the compression apparatus over the back of the head. The usual length of exposure in Germany is two to three minutes, but it is quite possible, with good apparatus, to obtain brilliant negatives with exposures of ten to twenty-five seconds.

The length of exposure, and the degree of penetration depend somewhat upon the thickness of the skull, which varies greatly in different individuals. For determining the degree of pentration of the ray, and for estimating the length of exposure necessary in a given case, I like to observe the degree of fluorescence produced on a barium platinum-cyanide screen by the X-rays which pass through the skull of the subject at the time the exposure is made. This is one reason why I do not use the Albers-Schonberg apparatus. I work with my patient lying face up on a canvas stretcher. I place the tube and diaphragm under the stretcher, support the plate over the face, place a fluorescent screen over the plate, darken the room, and watch the effect of the rays on the screen. Two advantages of this method will be apparent at once. The patient is more comfortable, and hence less likely to move during the exposure, and then, if the penetration of the tube changes and becomes too high or too low, it will become

apparent at once to the operator, and the exposure may be terminated without delay.

The appearance of a radiograph of the face and its usefulness in diagnosis depend much upon the position of the tube and the direction of the rays with reference to the base of the skull. We must avoid superimposing the shadow of the horizontal plate of the frontal bone upon that of the frontal sinus, or the shadows of the petrous bones upon those of the maxillary sinuses, or the shadow of the basilar process of the occipital bone upon that of the ethmoid cells. Any of these undesirable results and some others as well may occur if the exposure is made in a careless manner. The necessity for a standard distance and position of tube is, therefore, apparent.

The direction of the rays with reference to the plane of the photographic plate is comparatively unimportant, and since we must bring the plate as close as possible to the face, this direction will be determined by the prominence of nose and forehead, and therefore subject to considerable variation with different individuals.

The distance of the source of X-ray (the target of the tube) from the face and the plate is, however, of some importance, partly because upon it depends the amount of divergence of the rays which give us the shadow picture. Considerations of safety to the patient and length of exposure are, however, the chief factors which determine this distance. I find that 18 inches answers all the requirements for safety and that this distance does not necessitate longer exposure than about 20 seconds for the antero-posterior projection and 10 seconds for the transverse projection.

In order to secure a standard position for the source of rays we may select one of the diverging rays which produce the picture and measure the angle which it makes with a plane corresponding approximately to the base of the skull. The ray I have selected for this purpose is the ray which passes through the skull in the mesial plane and pierces the center of the glabella. This ray I have called for convenience the principal ray. A suitable plane which can be readily located by external landmarks is the one which passes through the centers of the external auricular orifices and the center of the glabella. To save time I shall call this plane the basal plane and the angle between it and the principal ray, the principal angle. With a fixed distance between the target of the tube and the glabella

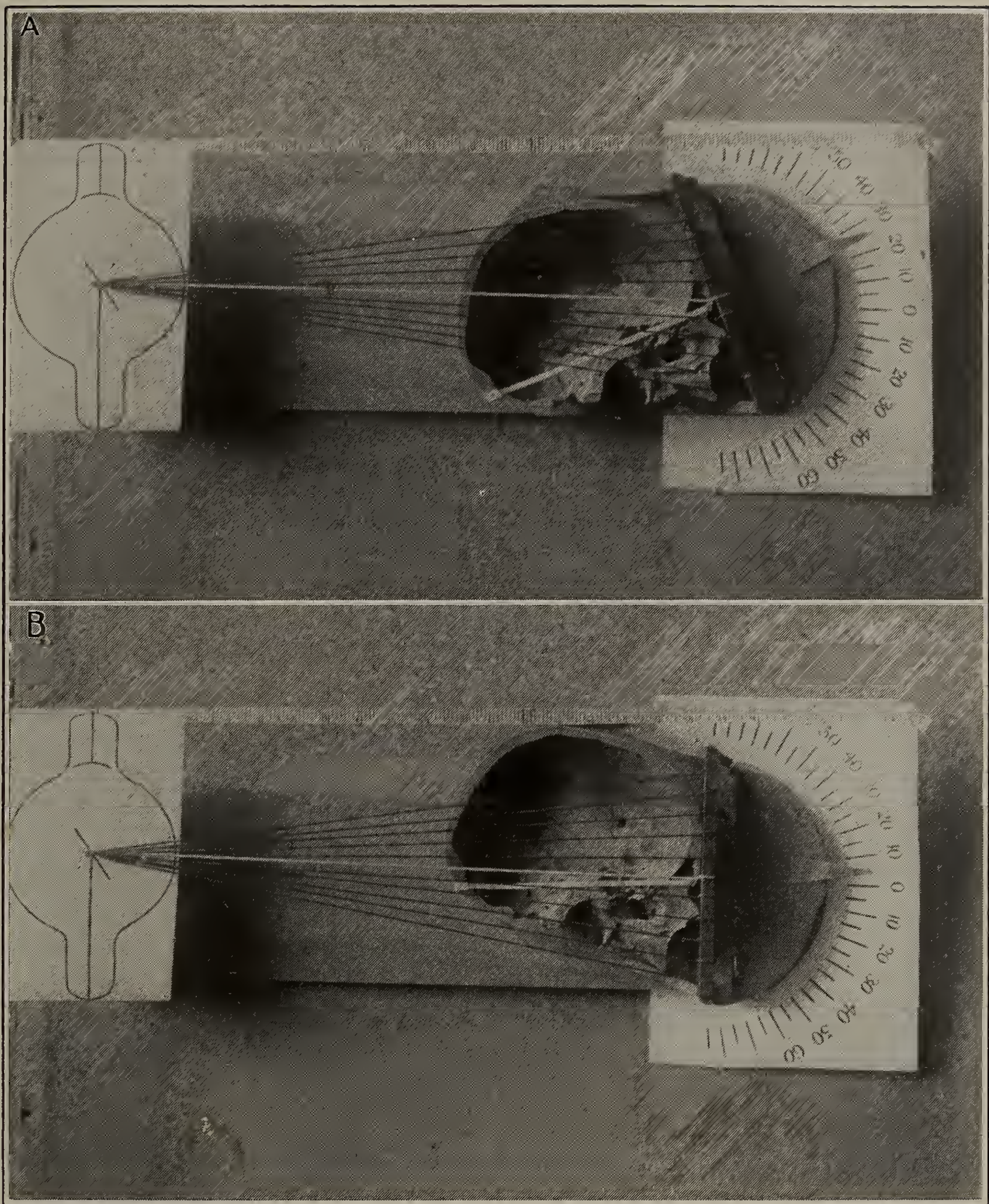
the general direction of the rays may be expressed by the measurement in degrees of the principle angle.

From measurements of a number of skulls which had been split in the median plane, and from a number of radiographs of skulls and heads at different measured angles I have found that, with the target 18 inches from the plate at the glabella, the best results are obtained when the principal ray makes an angle of from twenty-three to twenty-eight degrees with the basal plane. I have therefore adopted twenty-five degrees as the standard angle for the principal ray, and the basal plane, or the standard principal angle. With this distance of tube and direction of ray, the shadow of the edge of the horizontal plate of the frontal bone, where it joins the wings of the sphenoid, appears as a transverse line passing across the orbit about one-half inch below the supra-orbital ridges. The appearance, in a symmetrical picture, of this shadow in the position mentioned is a fair indication that the principal angle is approximately correct. I regret to say that some of the plates I shall show here were made before the importance of this angle was apprecaited, and before we had accurate means for adjusting it.

A few degrees variation from this standard direction is unimportant, but accuracy and uniformity are desirable. In order to obtain a fair degree of accuracy, I have arranged my tube with an indicator of transparent celluloid which locates the principal ray, and a scale graduated in degrees, which shows the angle between the principal ray and the perpendicular.

I have also a little instrument which measures approximately the angle of the basal plane with the perpendicular. This device carries a conical plug, which fits into the external auricular orifice, and a ruled celluloid strip which can be adjusted so that the ruled line passes over the center of the glabella and therefore lies in the basal plane. A scale, graduated in degrees, to which is attached a spirit level, may be turned until the zero point on the scale is perpendicular. In this position, one of the little pointers indicates the angle of the basal plane with the perpendicular, and the second pointer, placed twenty-five degrees away, indicates on the scale, the correct angle for adjusting the tube holder.

With the Albers-Schonberg apparatus, the same result may be obtained approximately by placing the tubular diaphragm in such a direction that its axis lies in the plane passing through the glabella, and about three-quarters of



Two photographs of a model constructed for showing the effects of changing the position of the tube with reference to the skull. The direction of the rays in mesial plane is shown by stretched elastic cords passing from a point representing the target of tube to a bar placed in front of face and representing a line in the middle of plate. The principal ray is represented by a cord of lighter color than the others and the basal plane is shown by a strip of tape fastened to the skull at its base.

In A, the principal angle is approximately 25°, and it will be seen that the rays passing through frontal sinus are not obstructed by irregular parts of the base of skull.

In B, the principal angle is too small (about 5°). In this position the shadows of parts of base of skull would be superimposed upon those of the sinuses.

an inch below the parietal eminences on each side. It is understood, of course, that in making the antero-posterior projection the principal ray, or the axis of the Albers-Schonberg cylinder lies in the median plane of the body.

The radiograph of the head in the transverse direction, is comparatively easy to make, and is of little importance. It gives an idea of the depth of the frontal sinus, and a knowledge of this depth is sometimes useful in interpreting the shadows on a so-called "front view" plate. The outline of the sphenoidal cells may be shown in the lateral projection, but I am told that this is of little use to the surgeon. I therefore make this plate with especial reference to the frontal sinus. The plate is supported parallel to the median plane, and the ray passing through the center of the glabella is perpendicular to the plate. The sphenoidal cells may be best shown by passing the perpendicular ray through the middle of the line joining the external auricular orifice, and the external angular process.

It is well known that photographic prints of X-ray plates fail to show the detail of the original negative. This is especially true of plates of the skull. In these sinus plates, the print is particularly disappointing, and we rely solely up the negative. Contact copies on glass are difficult to make, and they seldom show as much as the original negative.

The examination of these negatives is facilitated by having a dark mat around the part of the picture we want to see. I therefore make these radiographs on plates eight by ten inches, and have devised a method of giving them a very dense black border, which is as follows: After the exposure is made, I cover the plate with a piece of cardboard the exact size of the plate holder. This cardboard carries at its center a sheet of lead of sufficient size to cover the useful part of the picture, and carries also the words "right" and "left" with the plate number in lead letters and figures. An exposure to X-ray of about three seconds through this cardboard and lead, produces in the developed plate a dense black border around the useful part of the picture, which has been protected by the lead plate, and leaves the indicating words and figures on the plate in the proper position. The appearance of the black border in the developing tray is found to assist materially in examining the plate by ruby light to determine the stage of development.

DISCUSSION ON DR. CALDWELL'S PAPER.

Dr. George E. Pfahler, Philadelphia:—The society is indebted to Dr. Caldwell for this excellent presentation of this subject. This also gives me an opportunity to mention another point. That part of the profession that is interested in the study of frontal sinuses was pleased at the light that the X-ray threw on the study of these sinuses about a year ago and we wondered who really did the work. Now we learn that this beautiful work was done by Dr. Caldwell.

Some clinicians will accept such hard labor and beautiful work without giving credit to the man who did the work. We should insist on receiving at least half the credit when we do all the work. I shall insist when doing this work in being a joint author of the paper, instead of not being mentioned. I read one of Dr. Coakley's papers about a year and a half ago, but found no mention made of Dr. Caldwell, although he did all the X-ray work.

About six weeks ago in a case of alopecia I wanted to examine the progress I was making in the treatment of a round cell sarcoma of the frontal sinus. I made an exposure of thirty seconds, although usually I make it in ten or twenty-five seconds; but in this instance I wanted to be sure of my results. About four weeks later the patient lost the hair exactly corresponding to the outline of my diaphragm. This emphasizes the importance of short exposures and the use of the filter. I treated that patient for nearly three years and was one of the first on whom I used the leather filter and she first recognized the absence of a burning sensation when the filter had been used. I believe that if I had used a filter in the instance mentioned that it would have saved that patient's hair.

As to the angle. When Dr. Caldwell read his paper, I thought that he was making the angle in the opposite direction as I have been doing. Albers-Schoenberg makes his plates with the angle in the opposite direction from the base of the skull. Albers-Schoenberg passes his rays through a line drawn through the glabella and lower portion of the mastoid process which will throw the rays below the skull, and it seems to me that that should give us at least a better view of the antrum of Highmore. It may not give quite as good a view of the frontal sinus, but I am quite sure that it will give you something, and the rays pass through the spinal column very near the second vertebrae and those rays are so much diverted by the time they reach the plate that they do not obscure the shadows of the frontal sinus.

Dr. Alfred L. Gray, Richmond, Va:—I want Dr. Caldwell, in closing his discussion, to tell us how he can determine whether the cavity is filled with pus or whether the shallow is caused by an abnormal thickening of the bone. It has been my experience in observations of frontal sinuses that very often we find one plate considerably thicker than it is on the other side. I would like to know how Dr. Caldwell determines that point.

Dr. Percy Brown, Boston:—Dr. Caldwell spoke of using a hard tube, and yet not one that is too hard. I should like to ask him if he can give us approximately, in terms of Walter, the hardness of the tube he uses in the ordinary skiagraphic procedure.

Dr. Lewis Gregory Cole, New York City:—I think that the paper which Dr. Caldwell presented, especially the matter of the angle, is very fine. I have done some of this work and I have followed in a way the same angle Dr. Caldwell has, that is, having the ray come through in the same direction he does, although I have not measured it with the same accuracy.

I would like to ask him with what degree of certainty he can make a negative or a positive diagnosis as to the presence of pus in the cells. In some of the plates shown there is no question as to the diagnosis, but in the borderline plates, I wish he would tell us how he makes his diagnosis.

Dr. Caldwell, closing the discussion:—With reference to Dr. Pfahler's criticism, I think he has overlooked the fact that the author of the papers he mentions has not claimed that he made the radiographs himself, but has given full credit to the Roentgenologist. I fear that Dr. Pfahler is a little overgenerous to the X-ray worker.

We are indebted to the clinician for material for suggestions and for his demonstration of the usefulness of the X-ray in this comparatively new field.

I have never tried to make a radiograph with the tube placed so that the rays which cast the shadow of the frontal sinus must first pass through the cervical vertebrae and the base of the skull. The shadows of these irregular bones superimposed upon that of the frontal sinus would in my judgment, be far more objectionable than those produced by the comparatively smooth and regular bones of the skull with the direction of rays I have used.

When the radiograph shows that there is something in the sinus which casts more of a shadow than is normal we assume that this is fluid. We have not been deceived by thickened bone on one side. I fancy that the shadow due to thickening of the bone would not be sharply limited by the septa as is the case with those due to cavities filled with pus.

As to the accuracy of this work I cannot tell. I imagine we have about the same degree of accuracy that we have in raying for kidney stones.

I do not use any of the well-known penetration gauges for the reason that the tubes may change so quickly during the exposure that a measurement made before or after will not be reliable. I gauge the penetration by two things. By the appearance of the fluoroscopic screen during the exposure and by the reading of the milliamperemeter in series with the tube. With a certain interrupter and coil, with the rheostat resistance all out, a reading of ten milliamperes shows that the penetration of the tube is about high enough. This method of gauging the penetration has proven quite satisfactory in my work.

THE INDUCTION COIL. A STUDY OF THE CAUSES OF INVERSE DISCHARGE.

H. Clyde Snook, A.B., A.M., Philadelphia, Pa.

The great problem in the use of an induction coil for X-ray work is the finding of some means for preventing the current from passing through the tube in the wrong direction.

This current which tends to pass the wrong way through the tube has come to be known as the "inverse discharge."

Its baneful effects are well known, but its causes have not been so well understood.

Since they are the standard type in universal use, let us consider coils of the Ruhmkorff type when used with the different kinds of interrupters. Upon examining them we find that the voltage of the "inverse discharge" varies greatly, being higher the longer the spark length of the coil, and varying in coils of different makes from 5 to 20 per cent of the total spark length of the coil.

(S. No. 1.) The current curve in the primary of a coil operated with an electrolytic interrupter, when the primary has no secondary around it looks like this; provided the primary has a certain self induction and the interrupter a definite adjustment. The curve shows the current rising against the counter E. M. F. of self-induction and reaching a steady limit set by the resistance before it is finally interrupted and suddenly brought to zero. (ind.) This is the "break" and is the time when the high voltage would be induced in the secondary if it were associated with the primary. During the rise of the current against the self-induction we have the "make" and it is at this time that the secondary would have induced in it a voltage of potential opposite in sign to that induced at "break;" and if it produced current in the tube it would be our enemy, the "inverse."

(S. No. 2) If we increase the voltage used with our primary coil and electrolytic interrupter, or if we decrease the self-induction of the primary—leaving the interrupter at the same adjustment—we get a curve something like this. The frequency of the interruptions increases and the current rises more abruptly at the "make." The voltage

Read by invitation before the 7th Annual meeting of the American Roentgen Ray Society at Niagara Falls, N. Y., August 29 to 31, 1906.

induced in the secondary is a function of the steepness of the current curves of the primary. It is thus seen that the voltage of the "inverse" is increased by decreasing the self-induction of the primary or by increasing the primary voltage on which the coil is operated.

(S. No. 3) If we use a large value of inductance in the primary the curve may not be flat on top, but may be like this. We notice that the curve is not so steep at either "make" or "break" as when we used lower values of inductance. This curve would indicate a very greatly reduced inverse voltage and a somewhat reduced direct one.

(S. No. 4) If a mechanical interrupter of some kind be used, such as a platinum hammer break, or a mercury dip, or a mercury jet interrupter, a condenser must be bridged across the break to minimize the arcing at the contacts and to permit of a sufficiently sudden interruption of the current. Otherwise the coil will operate very indifferently and the contacts will be rapidly burned up by the arcing. A primary—without a secondary around it—operated by a mechanical interrupter may give a curve like this No. 4 We have a few saw teeth in this curve. (ind.) This horizontal line we remember, represents the progression of time from left to right. Above this line current is positive, below it, negative. At the time of "break" we find the usual sudden fall of current immediately followed by three saw teeth below the line and three above it. This is the oscillation of the condenser which is bridged across the contacts of the interrupter. Since the condenser is charged by the interruption of the circuit, it discharges back through the primary coil and line, producing a damped train of electrical oscillations, which in this case died down to zero in about 2½ complete cycles.

The number of oscillations per second under conditions such as these is

$$n = \frac{1}{2\pi}\sqrt{1/LC - R^2/4L^2}$$

where L is the self-induction in the circuit, C is the condenser capacity, and R is the resistance. If R is so small that $R^2/4L^2$ can be neglected in comparison with $1/LC$, then the frequency

$$n = \frac{1}{2\pi}\sqrt{LC}$$

In this particular curve the frequency of this oscillation is approximately 800 cycles per second.

(S. No. 5) If we take a somewhat large value of inductance, or of capacity, or of both, as in this curve No. 5, when all other conditions are maintained as they were

in curve No. 4, we find that at "make" the self-induction keeps the curve from being steep, that at break the current does not fall so abruptly to zero, that the period of oscillation of the condenser has very greatly increased, and that the amplitude of the condenser oscillations is quite large indeed.

(S. No. 6) Should we use still larger values of inductance and capacity we should get a curve in which a trifle over 2½ oscillations of the condenser occupy the entire time of no contact at the interrupter and the amplitude is still greater.

(S. No. 7) Curve No. 7 is of current in a primary of high self-induction, no secondary around the primary, but with the condenser oscillations damped to such a degree that a single half period can scarcely be distinguished.

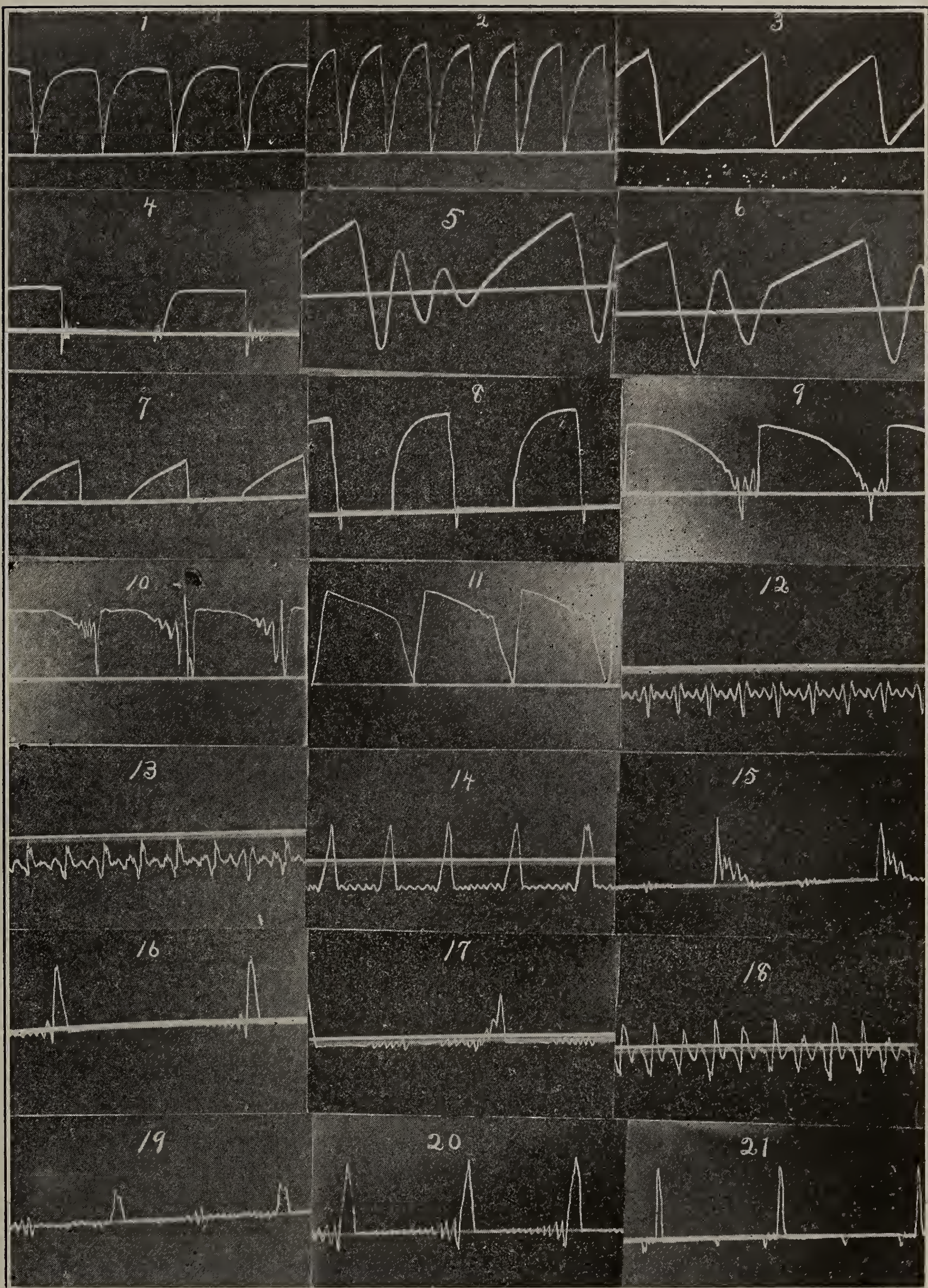
(S. No. 8) Curve No. 8 was taken under conditions exactly similar to No. 7 excepting that less inductance was used. The expected steepness of the curve at "make" is to be noted.

(S. No. 9) If we now put a secondary around our primary, and again using the electrolytic interrupter, we operate the apparatus so that we have a high voltage induced in the secondary winding, but with no sparking at the secondary terminals, we will obtain a current curve in the primary somewhat like this curve No. 9. This is a more complicated curve than we obtained under exactly similar conditions without a secondary being associated with the primary. The new wiggles in the curve may be explained in brief as being due to brush discharges from the terminals of the secondary and the oscillation of the secondary as an open circuited resonator, mainly the latter.

(S. No. 10) If we permit sparking at the secondary terminals—the bright snappy kind of a spark—but maintain all other conditions as in curve No. 9, we get this curve No. 10. Here we have the saw teeth due to the oscillations of the secondary, but the decrease of the self-induction of the primary caused by the sparking is very marked.

(S. No. 11) By operating the coil at its full output and producing a fat, fuzzy spark between the terminals we obtain a current curve for the primary as No. 11.

When a mercury jet or platinum break is used the current curve in the primary is very complicated if sparking is permitted to take place at the terminals of the secondary or if an X-ray tube is excited by the coil. The



OSCILLOGRAPHIC TRACINGS TO ILLUSTRATE MR. SNOOKS PAPER

discussion of a number of such curves which the speaker has taken from different coils is beyond the scope of this paper and are therefore omitted.

(So. No. 12) Upon investigating the currents which flow in the secondary coil at its middle, we discover that even without sparking at the terminals, or the operation of a tube, that current is flowing in the secondary at its middle. This is a necessary condition from the oscillations occurring in the winding of the secondary, which were noted before. This curve, No. 12, is of this oscillating current when the electrolytic interrupter is used with a low value of inductance in the primary.

(S. No. 13) Curve No. 13 was taken under the same conditions as No. 12, with the exception that a bright snappy spark was occurring at the secondary terminals. The effect of the sparking is seen in the extra tiny wiggles and the slight change in contour of the larger waves. (ind.) Here is one place at the time of one "break" of the interrupter where the spark failed to occur at the secondary terminals. It is seen that the tiny wiggles are absent and the wave shape is exactly like that of the waves of the last curve.

(S. No. 14) With a flaming spark at the secondary and a high value of inductance in the primary the electrolytic interrupter will give a wave like No. 14 at the middle of the secondary. (ind.) This high wave peak is the direct current or current going in the direction of that induced in the secondary at "break." (ind.) While these little wiggles are again the oscillations of the secondary, but they are not so great in amplitude as those of the two preceding curves.

(S. No. 15) No. 15 is the current curve at the middle of the secondary when bright sparking takes place at the secondary terminals and the coil is operated by a platinum hammer break with a medium inductance of the primary and a medium condenser value. Current above the zero line is "direct"—below it, "inverse." This shows very little "inverse," and since it is taken at the middle of the secondary, it does not necessarily indicate "inverse" in the spark.

(So. No. 16) No. 16 is similar to No. 15, but the electrolytic interrupter is used. Current is passing through a high value of inductance is in the primary. The saw teeth following the peaks of direct current indicate very clearly the prolonged oscillation of the secondary.

(S. No. 17) No. 17 is identical with No. 15, but a harder tube is used and the current does not rise to so high a value because of the increased tube resistance. The condenser oscillations are seen to serrate the wave form of the current at break, and when the latter has fallen to a low enough value they produce an "inverse" current.

(S. No. 18) With a low value of inductance, a high frequency of interruption, a soft tube and the electrolytic interrupter, the current curve at the middle of the secondary is as in No. 18. There is a great deal of inverse as is seen by the waves below the zero line.

(S. No. 19) No. 19 is current in the secondary at its middle when a mechanical interrupter, quite high primary inductance and a large condenser are used with five milliamperes in a soft tube. The inverse due to the condenser oscillations is almost absent. The secondary oscillations are readily seen at both "make" and "break," while the longer wave of the condenser oscillation lies between "make" and "break" with its smooth curve ruffled by the secondary oscillations.

(S. No. 20) No. 20 is exactly the same as No. 19, excepting that the electrolytic interrupter is used.

(S. No. 21) We have here in No. 21 the curve of current not at the middle of the secondary as in the last few previous curves, but the curve of current which actually passes through the tube. With a very low value of inductance, a large condenser and a mechanical type of interrupter an inverse discharge was produced which passed through a fairly hard tube along with the direct current. Taking as land marks the tall peaks of "direct" current which come at "break," we notice the inverse current at "make" and also at one of the semi-oscillations of the condenser. This inverse due to the condenser oscillations occurred at the first semi-oscillation which produced "inverse" voltage, and it is to be noted that the succeeding condenser oscillations were unable to produce enough potential to equal the ionization potential of the tube. The abruptness with which the current in the tube begins and ends at this semi-oscillation of the condenser, in spite of the fact that the current through the primary due to the condenser oscillation is a damped sine wave, proves the existence of a very definite ionization potential for the tube. And it shows also that although the ionization potential may not be the same for the continuation of the current as for the establishment of it, yet the potential necessary for the continuation of the current is just as definite in value as that

for its establishment. The oscillation due to the capacity of the tube electrodes, the wires leading to it and the secondary coil are seen in small waves between the peaks of direct and the inverse caused by the condenser.

(S. No. 22) In No. 22 we have everything the same as in No. 21 but that the condenser and inductance have been adjusted so as to prevent the passage of the "inverse." The curve is entirely above the line. This is as it should be and is often difficult to obtain.

(S. No. 23) With a very large value of inverse at "make," when a soft tube and low inductance is used, we obtain a curve for the tube current as in No. 23. A slight peak of inverse from condenser oscillation can be seen in this curve.

(S. No. 24) No. 24 gives us the curve of current in a tube when there is no inverse present and the coil is being operated properly with an electrolytic interrupter.

The study of these curves has revealed several causes of "inverse discharges." Our old idea that "inverse" tends to form at "make" with all types of interrupters is confirmed as being correct so far as it goes. But we find additional sources of its formation. Two principal additional sources are the oscillation of the condenser bridged across the break, and the oscillation of the secondary itself as an open circuited Hertz resonator. A third source of minor importance is the oscillations due to the capacity of the electrodes of the tube and the wires which lead from the coil to the tube.

To minimize the formation of inverse due to the "make" the coil maker must use generous proportions and large quantities of material.

It is difficult to strike a balance between the "inverse" and the cost, but even when no limit is placed to the cost the "inverse" voltage is never made zero—it is only reduced—and there is still danger of its passing through the tube.

If coils did not deliver any inverse voltage there never would arise any question regarding the "number of layers on the primary" and there would be no need of selecting the proper inductance value for a given degree of tube vacuum.

It seldom occurs—very seldom occurs—that the tubes in common use will permit the passage through them of current due to the oscillation of the wires which lead from the coil to the tube; but in some coils the oscillations of the secondary very frequently get into the tube.

In addition to proper coil construction which will reduce the inverse voltage, there may be used in series with the tube resistances of various kinds which will minimize the inverse current. Among these are many kinds of spark gaps and valve tubes. The speaker has studied these very carefully and has found that a good valve tube is the most efficient of these devices when its vacuum is maintained at the correct point. It has the serious objection that this maintenance of the correct vacuum is difficult and troublesome—especially when heavy and long duty is demanded of it. A plain series spark gap is the simplest and easiest thing to use. It is better than most so-called valve tubes, but is not nearly so efficient as a really good valve tube. The great advantage which a good valve tube has over the series spark gap is that the tube offers very little resistance to the direct discharge and a large resistance to the "inverse," while the series spark gap offers as much resistance to one as to the other.

It is beyond the purpose of this paper to discuss the types of interrupters which may be used successfully with a Ruhmkorff coil, except to note that all have objectionable features of cost, construction and maintenance, and that all without exception are impotent in suppressing the "inverse" voltage. All platinum contact breaks require filing and occasional renewal of the platinums, while once in a great while a spring is broken.

All electrolytic interrupters are mussy and those which employ sulphuric acid as the electrolyte emit a corrosive acid spray destructive to furniture, clothes, carpets and floors.

All mercury interrupters require periodical cleaning because of the churning up of the mercury into a black mud.

The mercury turbine jet interrupter gives trouble when its contact segments wear away by the arcing at "break" and the amalgamation with the mercury.

The curves which have been shown are a part of a number which have been taken by the speaker from coils operated by the three types of interrupters—platinum, mercury and electrolytic.

The recording apparatus was a Duddell high frequency oscillograph. Other work, the logical sequel, has been done by the speaker and a record of it must be reserved for another time.

The investigations which are the basis of this communication were carried out bv the speaker in the Randal Morgan Laboratory of Physics of the University of Pennsylvania under Dr. Arthur W. Goodspeed, a member and former president of this society, and to him at this time the speaker desires to express his gratitude and appreciation for the facilities placed at his disposal.

DISCUSSION ON MR. SNOOK'S PAPER.

Dr. Reginald Morton, London, England:—I wish to congratulate Mr. Snook on the excellent work he has done. This is of great importance to us in England where we have been suffering as much from inverse discharges as you have. I thought also that I might bring to your notice a new instrument in this connection. It was first described about a year ago in a German paper and is called a vacuum vacillograph. As you may know the Dale vacillograph costs from five hundred to a thousand dollars, and unless you are trained in its use, you must have some one run it for you; but the little instrument to which I refer is absolutely correct and accurate and will give you a true rendering of any current you can get through it.

The instrument consists of a plain vacuum tube cylinder two inches in diameter and fourteen inches long. It has two nickel electrodes which nearly meet in the center. As soon as the vacuum is about five or six millimeters of mercury (this is rather critical and must be gotten right, but it never changes afterward) as soon as the current passes through this, it must be up to five hundred or thereabouts, you can put it in series with an X-ray tube, and it shows exactly what is passing through the circuit. Whichever electrode happens to be negative becomes covered with a purple coating, which, if examined carefully looks like a glove or stocking being pulled on. That is practically stationary, but if you examine it with a rotating mirror the whole matter becomes opened up. You will get true sign curves and instead of coming out like a thin line you get a cone showing a solid block of violet light. By running the mirror with a motor you can photograph the image with ease. There is a band of bright light between the electrodes which comes out white and bright, and on the photographic film makes a white line, which gives the zero line. Putting it in series with the X-ray tube shows that the impulses passing through the tube are exceedingly short. There is nothing in all my work with this instrument that impressed me more than that. They are exceptionally short if you are using a main current, fifty cycles per second, by turning the mirror rapidly the width of the base line will be three times its height. You can make long fat line or you can get short ones. When you try the current going through the X-ray tube you will find that no matter how fast you spin the mirror you cannot lengthen the wave out any perceptible degree, and it is as nearly momentary as anything can be imagined to be.

I imagine that the spots which Mr. Snook showed are due to some error. The instrument I mentioned can be bought for from five to fifteen shillings, and I strongly advise you all to obtain one and use it. It will give you an added interest in the physical side of your work.

Dr. Wells, St. Louis, Mo:—I wish Mr. Snook would tell us something about the selection of a proper series gap. There is certainly a difference in the performance of the ordinary air gap and the point and plate multiple gap. I can appreciate this excellent paper only in its essentially practical aspect, and this is one point suggested during its reading. He said nothing about it. There is a difference in the various series gaps that have been provided with the various equipments of different makers, especially with reference to the width of the disc in the point and disc rectifying multiple gap.

Dr. W. S. Lawrence, Memphis:—Last winter I worked quite awhile on the spark gap proposition, and I thought I had devised something that was new with point and disc. The one I devised works excellently, and I do not think that Mr. Snook's passing word is sufficient on this point.

I notice that a spark gap constructed by one of the makers is all together on a wrong principle, a point and disc spark gap it is, but the points are too close to the discs. The advantage of the disc and point spark gap is this: when the disc is positive the current will tend to leap from its outer edge to the nearest point; when the point is positive, the current will leap from the point to the nearest part of the disc which is its center opposite the point. Now the distance between point and disc can be so arranged as to make the path of the current when the *disc* is positive of maximum length and the path that the current will take when the *point* is positive of minimum length. This distance is found by trial to be one-half the diameter of the disc. With this distance the resistance of the two paths offered to the current is about in the ratio of 5 to 7. For example, say that the diameter of each disc is ten millimeters. In such a series the points must be five millimeters from center of discs to get the maximum efficiency. Then when the current is passing in the direction from point to disc, it will have this distance of five millimeters to jump. If you reverse it, the current will not jump from the center of the disc to the point, but from the edge of the disc to the point, and it will have a greater distance to pass through. The square of five being twenty-five, and the diameter of the disc being ten, will make from its center out to its circumference five, and the square of this twenty-five; adding that together makes fifty, and taking the square of that will give the square root of the hypothenuse of a right angled triangle, which is about seven—seven times seven being forty-nine—so that the distance the spark must jump will be seven millimeters. And that is where the advantage comes in. It has only five millimeters to jump in the one case and seven millimeters in the other. If you have a series often, you get seventy millimeters which it must jump in one case when going in an inverse direction, and only fifty millimeters of air to jump when it is going in direct direction. The sides of similar triangles being in proportion, this ratio holds good for any size disc.

That is the principle on which I constructed my series spark gap, and it seems to work very well. If you put the point very close to the disc, the current will not jump from the edge of the disc to the point, but from center to point, and the distance is about the same, no matter which direction the current is going; while if the point is placed at greater than radial distance from the disc, the length of the path traversed by the direct current is increased more rapidly than the length of that traversed by the inverse current.

Dr. Rome V. Wagner, Chicago:—I think that the use of these vacuum tubes in series with an X-ray tube is quite an advantage to

those working with the coil apparatus. There is unquestionably a very little resistance added in circuit with the tube, and you can select the proper spark gap. As soon as you find that there is inverse current, you can increase or decrease the spark as desired to prevent its action.

The objection that the spark gap offers resistance to the current in right direction as well as in wrong direction is not a great one, especially if you have a coil giving a longer spark gap than is required to overcome the resistance of the tube. When a tube backs up over six inches it is too high to be operated safely. The vacuum of the tube should be lower than this or it is liable to be punctured. I think that in coil construction the great feature is the interrupter.

I have been experimenting for some time trying to overcome the objectionable features of the interrupter and the trouble and annoyance occasioned by the care of the interrupter. I worked a number of coils by interrupting the magnetic circuit instead of the electrical circuit. After I got this about perfected and had told a number of X-ray workers that I expected to manufacture a coil of that kind, I discovered a simpler and more effective method to do away with the use of the interrupter. The way I wind the primary of the coil is with two windings. (It is difficult to describe the coil without a blackboard or drawings.)

The current is generated in the secondary of an induction coil from the magnetic action of the iron core. If the core is magnetized from a primary operated with the direct current, every time the current is turned on the core magnetizes and generates an impulse by induction in the secondary in one direction, but when the current is turned off the core demagnetizes and generates an impulse in the secondary in opposite direction. Current generated by the demagnetization of the iron core is very much stronger than by the magnetization of the iron core. Current generated by the magnetization of the iron core is called the inverse current. The current is turned on and turned off or interrupted through the primary winding from 1,000 to 3,000 or 4,000 times a minute by the ordinary interrupter. Every time the current is turned off the arc or spark formed at the breaking of the contracts produces waste which requires repeated adjusting and replenishing.

To overcome these objections I have devised a means by which the current is reversed through a part of the turns in the primary winding. In order to do this the core is wound with two wires instead of one so that the number of turns in the primary may be equally divided. Current is allowed to pass constantly through one-half of the turns and is alternated through the other half of the turns. When the current is passing through all of the turns in the same direction we have the full magnetizing force and when the current is passing in the opposite direction or reverse direction through one-half of the turns there is no magnetizing force and the result is the same as though the current were turned off entirely, thus we do not break the current, but merely switch it back and forth through one-half the number of turns on the primary.

A rotary pole changer for reversing the current through one-half the number of turns on the primary requires but little, if any attention and as the force magnetizing the core is cut off much quicker than a current of 3 to 5 amperes may be broken the efficiency of the coil is increased and we get away from so much of the condenser action that produces inverse current.

Mr. H. Clyde Snook, closing the discussion:—It gave me great pleasure to hear what Dr. Morton had to say in connection with this matter. Referring to the question of the periodic time of the system I was using, I wish to assure you that I calibrated it at the frequencies that we used on the curves you saw and that at the frequencies in those curves the system was not oscillatory and its period was much less than any recorded in the curves.

The second speaker requested a discussion of the correct value of the simple series spark gap. Dr. Wagner, in the first part of his criticism, answered the question as to how to adjust the spark gap by means of one particular method, namely the use of the vacuum tube or oscillatome. I would say that practically you are limited in increasing the length of the series spark gap or gaps which you have in series with the X-ray tube, because of the fact that your coil will not give a long enough direct spark or deliver enough current to the tube. When you cannot increase the spark gap sufficiently to equal this inverse voltage, it is then impossible to prevent the passage of the "inverse" by use of the spark gap.

Resort should be had then to other methods. It is best always to use all the means at our disposal. Use as high a value of self-induction in the primary of the coil as you can and still get sufficient current in tube so that the inverse produced by "make" will be at a minimum to begin with, and then the other remedies can be applied.

As for the point and disc. It is hardly proper for me to discuss that under the present circumstances, but I will say that when the point and disc is properly constructed, and used, that with small values of current passing through the point and disc multiple series spark gap, that then it is of value. But when the current reaches an amperage of perhaps two and a half milliamperes, then the point and disc is not superior to the multiple simple series spark gap. The reason for this may be found in the ionization of the air in the vicinity of the electrodes forming the point and disc, thus rendering nugatory the effect of the difference of density of potential on the two electrodes which causes the primary effect expected.

As for Dr. Wagner's scheme as he has explained it, unless it includes something radically more and different than he describes, the coil which he proposes will produce inverse voltage.

PERSONAL TECHNIQUE IN THE TREATMENT OF EPITHELIOMA.

Dr. Kennon Dunham, Cincinnati.

The fact that properly selected and properly treated epithelioma respond better to irradiation than to any other therapeutic agent is beyond discussion among men who have carefully studied the subject.

This statement might lead some careless reader to suppose that this opinion was born of one long and uninterrupted series of successful cases. It is my intention to state the opposite idea.

The present assurance of success with which I undertake the treatment of these cases is due to the fact that I feel it is possible to master the two qualifying adverbs in the first sentence, properly selected, and properly treated.

Selection of Cases—If the neoplasm is located on the face the X-rays pure and simple should have the first consideration, because nothing else gives such perfect cosmetic results. There has been one exception to this in my practice—the lower lip. I do not understand why (it may be lymphatic circulation) but I have had no epithelioma of the lower lip, which extend over the margin of mucous membrane from the skin, give me anything but trouble, until I operate most radically, dissecting out the lymphatics in the neck.

The cases which have given the greatest satisfaction and which respond the most readily to the rays have been those of mushroom growth and which did not extend far into the connective tissue, and those with heavy crusts and central ulcer which look like broken down warts that have gone to seed and finally rotted. Rodent ulcer, although slow to respond, gives wonderfully satisfactory results. There is another form which has given me much trouble. The thin squamous epithelioma which spread without piling up or eating into the epidermis and have a very vascular base. They occur in patients who have very fair and delicate skin. These cases will burn easily and although they can be kept practically well if carefully watched, and treated when necessary, they do not give the soft healthy connective tissue scar which we desire.

Read by invitation before the 7th Annual meeting of the American Roentgen Ray Society at Niagara Falls, N. Y., August 29 to 31, 1906.

There is no form of epithelioma except the lip that I have seen which has not been greatly improved by the rays alone. The recurrences usually occur in those cases which have grown far into the connective tissue and have involved the lymphatics. If you attack such a case as this through the X-rays alone you must know what you are about or you will make worse than a failure. The tumor will break down and be disseminated through the lymphatics and you had better not have tried. The cases of large epithelioma which appear upon the extremities or on the body and which have been long neglected because they are not conspicuous and have given little or no personal inconare dangerous to undertake with X-rays alone unless the patient fully understands the chances of spreading.

There are many instances in old people where the piling up of the epithelioma has not progressed so that it is ordinarily termed malignant. These are so easily removed by a few exposures that it should always be done, because malignancy frequently occurs later.

Treatment.—The statement that the X-rays break down, scatter the malignant cells through the body and often do more harm than good, is true, and is due to the very common procedure followed by many physicians of treating the case with any tube which is most convenient, high or low, near or far away from the lesion and letting it run regardless of consequences. Very much like kill or cure. The spreading is possibly due to the stimulating effect of small dosage. This is done by the sort of doctor, usually a dermatological specialist, who explains that all this talk of technique is just a bluff. But you gentlemen know better.

The technique which I now follow in case of lip where the mucous membrane and skin are involved is radical operation with careful dissection of all the lymphatics draining the part, and irradiation both before (until operation can be prepared for) and afterward for at least two months. The tube used is one which will back five inches of spark, while the milliamp-meter reads .6 of a M. A. at a distance of eight inches; expose ten minutes every second or third day with a leather filter interposed.

This is continued for twenty to twenty-five treatments and then carefully watched as long as I can keep track of the patient.

The mushroom growths which do not appear to extend deeply into the connective tissue I have never known to recur or to need surgical assistance. They dry up or fall out, either as a whole or in part and leave a clean wound which under antiseptic precaution rapidly granulates, the connective tissue fills in a soft scar which is often almost imperceptible. Tube is placed as close as apparatus will permit, spark gap three inches M. A., meter reading one milliampere or a little over. Exposure fifteen minutes repeated every day until there is a slight sign of reaction. This is often much more severe two weeks after the last treatment, but gives excellent results. Number of treatments, three to twenty.

Warty growths with nuclear ulcer are treated in practically the same way as the above, and although a few more treatments are necessary (ten to thirty) the results are universally good. These cases I have never seen recur.

Rodent ulcer requires more time, more care and sometimes the assistance of electrolysis, as I will describe later, but gives universally good results.

The tube used is harder, 4½-in. spark gap is backed up, one M. A. of current used and the tube with leather filter is brought as close to the ulcer as practicable. Exposure ten to fifteen minutes as the tube will stand. By this I mean that sometimes my anode gets very hot when I discontinue treatment because I do not know what I am going to do with a red hot anode.

Squamous epitheliomata with engorged base in fair skinned people.—This class of cases, as I have said, has given me a great deal of trouble. I can prescribe no definite form of treatment here, for I have tried them all and only get a partial recovery, although the tendency to recur is not strong and they become much improved. I have used both the hard tubes and soft tubes, placed close and far away, with and without epilation, but do not know which has given the best results. Dr. Williams, of Boston, uses upon these cases a very powerful specimen of radium with much benefit. I have not tried it, but hope to.

When the growth occurs around the alæ of the nose or the canthus of the eye there is a tendency to recur. This is not always the case, but I am always on my guard.

Whenever there is a recurrence, and at times upon rodent ulcer, and upon large epitheliomata of the body or limbs, which have penetrated deeply, I advise the following procedure:

Use the galvanic current as follows: Having cocainized the tumor or having anaesthetized the patient, completely surround the tumor with galvanized needles and connect these with the positive pole of the battery. A large surface of the patient's arm or leg having been closely fitted with a large negative electrode you may slowly turn on the galvanic current 30 to 110 volts according to the anatomical relation of tumor and large nerve trunks and allow the milliamp-meter to gradually run up to 80 M. A.; rest here for five minutes and then gradually cut out the rheostat until you have clinical reasons for stopping or have reached 400 M. A. It should take thirty minutes for the current to reach this amount. Many advise greater currents, but this is sufficient.

By this procedure you have closed the lymphatics and blood vessels surrounding the tumor and if you have driven the needle under the tumor as you would a spade into the ground, you have closed up many which lie below the tumor. Thus not only is the danger lessened of metastasis, but a large part of the tumor sloughs out with little or no pain and thus relieves the economy of the necessity of absorbing a large amount of proteid poison. This operation is immediately followed by irradiation, the character of which is entirely dependent upon the location, size and character of the tumor.

I have never been able to try this upon cancer of the breast, but shall upon my first opportunity.

This procedure appeals to me, first, because it works; second, because it closes the lymphatics and blood vessels by electrolysis and the eschar of the positive needle, until healthy granulation can do the work better; third, it leaves the wound open for irradiation; fourth, it saves the patient the necessity of absorbing a lot of virulent organic poisons; fifth, because the X-rays are not asked to do more than can reasonably be expected of them.

I have not spoken of the protection for patient or operator, but have left it until the last, because nothing can be more important.

All healthy parts are protected in any way which is surely adequate, even to using 1-16 inch of lead. No patient is ever burned unless it is intentionally done.

All assistants working with me must protect themselves or get out.

Dr. Jacobi, of New York, before the American Medical Association last June, told of the wonderful success he has

had during the last fourteen years by the use of methyline blue in cases of cancer.

I have tried it since in my cases—even of epitheliomata. It seems to be of some value. I have not had enough experience to decide.

In conclusion I can only repeat my first sentence, that properly selected and properly treated epitheliomata respond better to irradiation than to any other procedure.

DISCUSSION ON DR. DUNHAM'S PAPER.

Dr. Ennion G. Williams, Richmond, Va:—As to the use of radium in the treatment of small growths and in early recurrences, I have treated four or five recurrences about the size of a pea with radium, and in each instance the recurrence has disappeared promptly. I have also removed several warts.

Dr. George E. Pfahler, Philadelphia:—As to the statement made by Dr. Dunham that he believes that the rays disseminate the growth. If that it is true it is important for us to know it. We undoubtedly do more X-ray work in this society than is done by all other workers together, and, therefore, we probably are in a better position to study the results than is any one else. I would like to have all of the members discuss this point and give their opinion. Personally, I feel confident that I have never seen a case that gave me any reason to believe that the rays disseminate the growth. We know that the tendency of these growths is to disseminate. That may be due to the technic to which Dr. Dunham just called attention, but we must be careful in stating that the rays disseminate the growth unless we have the evidence to prove it. I wish Dr. Dunham would speak of that.

Dr. William H. Diffenbach, New York City:—At the clinics in Vienna last summer I noticed that the edges of these tumors are frozen with ethyl chlorid. The patient comes in for observation between radiations which are given, as a rule, in maximum doses instead of small repeated doses. The dead tissue is cleared away and generally ethyl chlorid is used for this purpose instead of the curette.

Dr. Wells, St. Louis, showed lantern slides to illustrate the limitations of the Roentgen ray in the treatment of cancer. Specimens of the infiltrating variety involving the cheek and lower lip were shown with end results shortly before death.

Many others of the more superficial sort were shown with end results, cured.

Dr. Wells stated it as his belief that in treating superficial epithelioma, the reaction of mild degree should be obtained as soon as possible and the patient then allowed to rest until the lesion passes through the evolution which usually follows the getting of this reaction. The work is thus done in successive stage until the final disappearance of the lesion.

Dr. Russel H. Boggs, Pittsburg, Pa:—I agree with Dr. Pfahler that the X-ray does not cause a spreading of carcinomata. I have treated a large number of cases, but have never seen one where I thought that the ray had disseminated the tumor. I have seen patients who had never seen an X-ray machine where the cancer had

spread to the adjacent lymphatics and on postmortem the liver and almost all the internal organs were involved.

Dr. William S. Newcomet, Philadelphia:—I think that Dr. Dunham has not given enough attention to the character and kind of cancer. The history of cancer on the face is often a very long one, extending 15, 20 or even 30 years, but not so in cancer elsewhere or around the lip. I think that the character of the disease has a great deal to do with the results.

Dr. Stevens:—I have been attempting to measure the dosage of the X-rays as well as I could, using large doses and infrequent treatments, and I get better results. The long continued application of the X-ray in small doses, even if it is done by an expert Roentgenologist, is irrational. If you do not secure results with epitheliomas in a reasonably short time with reasonable exposures it is better to discontinue because we have sufficient evidence in X-ray workers themselves that the X-ray produces the very condition we are trying to cure.

Dr. Andrew P. Biddle, Detroit, Mich:—I want to go on record as saying that the X-ray therapeutist needs a great deal of education in dermatologic lesions. I have seen in our city a case of the initial lesion of syphilis treated for a parasitic growth. We have all of us seen cases of supposed epithelioma that were nothing else than syphillis treated by the X-ray. We, the dermatologists, want you, the Roentgenologists, to educate us how to use the machine properly, but we want you to recognize also the fact that education is needed in the other direction as well by him who would apply his machine to therapeutic uses.

Dr. Dunham, closing the discussion:—There are only two points to which I wish to refer. The cases I reported were all diagnosed by dermatologists or surgeons. They send their cases to the clinic with a careful diagnosis. We only treat the cases for them. There is nothing that can be emphasized with more benefit than just the point made by Dr. Biddle, that we must not assume knowledge where we have it not.

I know that I did not discuss all the forms of epithelioma, but only attempted to give a few cases treated in a certain way. I did not intend to cover the whole field.

In regard to dosage if you will consider the doses of the X-ray employed by Belot and Beclaire in their clinics, comparing their massive dose with the average American massive dose, you will find that the small American and the very large French doses are much alike. There is about the same difference as between the French and American scale of measurement. My effort is to get my results as quickly as I can, and to do this I treat these patients every day or as fast as I can. Where I cannot get them every day, only once a week or once in two weeks, I use the massive doses. Otherwise I repeat the dose every day until I get a slight reaction and in ten days to three weeks you get a good burn.

The use of ethyl chlorid is a good suggestion. It is a mild way of getting results, and a much better one than the more radical method of curetting the tumor.

The matter of dissemination is a very important one. This subject was brought to my attention by a case brought before the Academy of Medicine in Cincinnati as an example of why the X-ray should not be used in the treatment of epithelioma. It was evidently a case where a very small tube had played on a very large epitheliona until there was very suddenly a large spreading of the tumor. You can

do harm as I have said by giving too small a dose. This is usually called a stimulating dose. It probably acts by stimulating the neoplasm to increased activity, but is not powerful enough to destroy it or to close up the lymphatics through which its cells are disseminated. Therefore your technique must be bold and heavy doses are necessary. If you do not do this you will have trouble. I believe that that can be avoided by proper technic and to assist that technique I have used the needle just as I told you.

THE TREATMENT OF MALIGNANT DISEASES OF THE BLADDER THROUGH SUPRA-PUBIC INCISION WITH REPORT OF A CASE.

A. L. Gray, M. D., Richmond, Va.

Mr. President and Gentlemen of the Society:

In none of the literature at my command have I at any time seen reported, favorable results from the Roentgen ray treatment of malignant disease of the bladder.

This condition is certainly of sufficiently frequent occurrence to justify the belief that it must have been tried, in many cases, before the involvement was so extensive as to render these cases hopeless when the treatment was applied, had the growth been easily accessible.

The now well known fact that the curative effect of the light is diminished to a very great extent in its passage through the superficial tissues and the inability to apply this agent in these cases without the most efficient rays being filtered out before it reaches the diseased area, must be responsible for the lack of more favorable results.

The problem of a tube of such shape and size as to admit of its introduction into the bladder *per urethram* and the generation of the light within that organ, is one that has not been satisfactorily solved and seems, especially in the male,to offer insuperable difficulties. Cytoscopy has been recently perfected to such an extent that intravesical growths may now be readily discovered on the first appearance of significant signs and symptoms, and we may hope that the factor of extensive peri-vesical tissue involvement when the patient is referred to us, may be to a great degree eliminated.

Read by invitation before the 7th Annual Meeting of the American Roentgen Ray Society, at Niagara Falls, N. Y., August 29 to 31, 1906

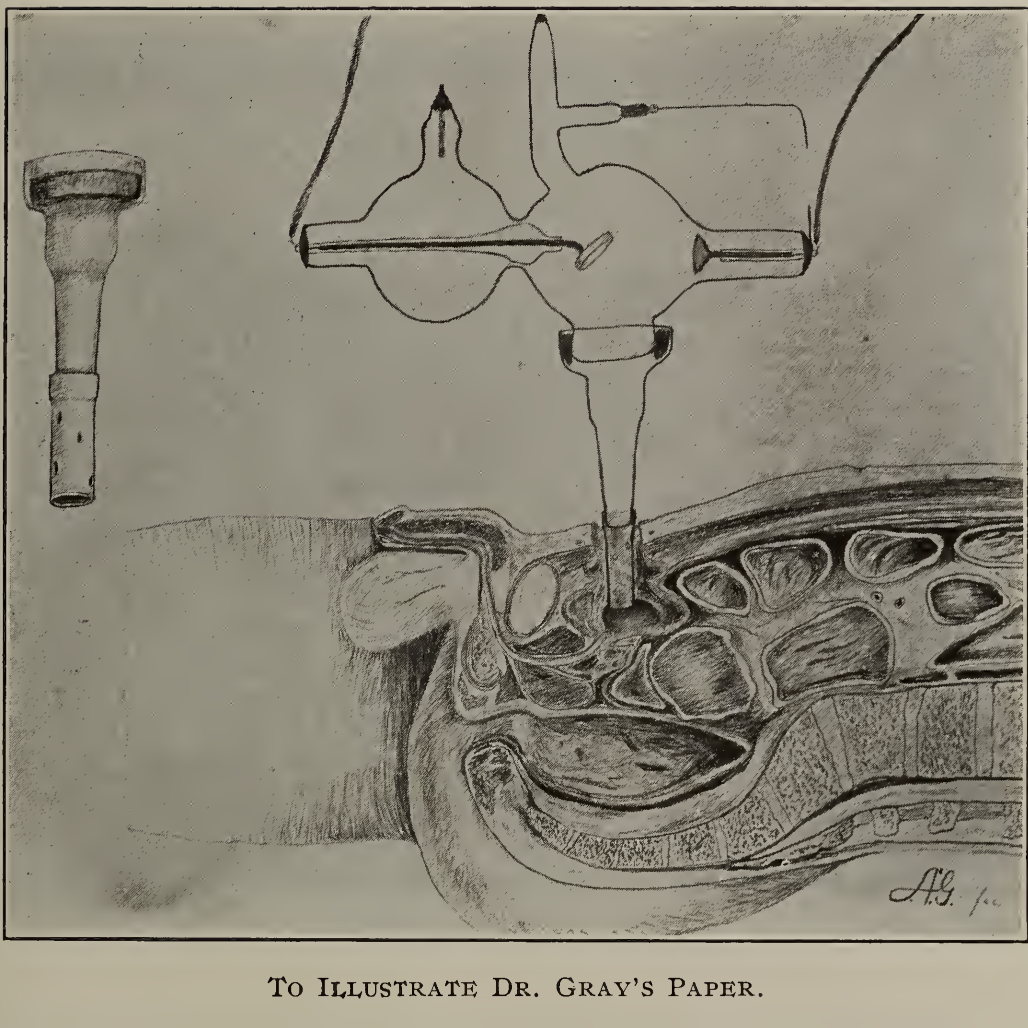
It seems to be the general experience of all Roentgen ray operators that the only cases in which we can, with any degree of certainty predict a cure, are those involving the skin and accessible mucous membranes, and doubtless the theory that the efficient rays are filtered out is the correct explanation. If the vesical mucous membrane be rendered accessible, we should naturally expect results similar to the treatment of like growths elsewhere.

However early a malignant tumor of the bladder be discovered, save at its very incipiency, surgical procedures cannot be expected to permanently eradicate the growth without the removal of so large a portion of the bladder wall that the patient, if he survive, must "eke out a miserable existence." It is especially desirable, therefore, that we devise some means whereby the tumor may be removed by the Roentgen rays.

The case which suggests this paper is as follows:

W., male, white, aet. 67; occupation, clergyman. Patient's trouble began in 1901 with dribbling after urination, which was the only evidence of disease at this time. Later the urine became muddy with a visible amount of blood present. This condition continued, and while there was only slight discomfort, not amounting to marked pain, he was beginning to be troubled with too frequent urination and consulted a specialist whose findings led to a diagnosis of cystitis and prostatitis. Since 1904 he had had several severe attacks of acute pain and tenesmus attended with the passage of dirty urine loaded with bloody pus, each attack lasting from one to two weeks and gradually subsiding.

November 1, 1905, patient presented himself to Dr. R. C. Bryan for treatment. He had been for some time wearing a rubber urinal on account of the almost constant dribbling present. Catheterization had never been necessary. Examination of his urine at this time confirmed the former diagnosis. A No. 27 F. sound passed easily; rectal examination, however, showed the prostate gland firm, free from tenderness, right side very slightly larger than the left. Repeated attempts at cystoscopic examination were unsuccessful on account of the hemorrhage present, though at different times silver nitrate and adrenalin irrigations were given. On account of persistent and alarming hematuria, supra-pubic cystotomy was advised and the operation performed January 5, 1906,—five years after the appearance of the first symptoms. A tumor was found "the size of a ten-year-old child's closed fist attached by a pedicle the size



To Illustrate Dr. Gray's Paper.

of wrist of a child the same age." The growth was removed by severing the pedicle at its junction with the tumor. On account of profuse hemorrhage the entire bladder was packed with gauze. On microscopic examination the specimen proved to be squamous cell carcinoma.

One week after the operation, X-ray treatment was begun. The tube used was Piffard's protecting tube with the smaller sleeve attached. In order to administer the light directly upon the growth, a large, somewhat stiff, soft rubber drainage tube was cut just long enough to reach to the growth and admit of the projecting end being slipped over the free end of the sleeve. By this device, the patient being in the dorsal position, the supra-pubic wound was effectively and painlessly held patent. Fenestrae were made in the rubber tube to prevent the urine from rising within it and a wick of gauze, placed alongside the tube in the incision, drained off the urine as fast as it accumulated. While the diameter of the rubber tube was less than that of the stump to be treated, it was estimated that as the growth should shrink under the influence of the light, gradually more of its surface would come within the field and therefore, should the treatment prove beneficial, ultimately the entire stump would have been exposed to the light. Treatments of ten minutes each were given every other day. Once a week the finger was introduced to ascertain the existing condition. Each examination showed a gradual improvement and finally the complete disappearance of the entire pedicle after twenty-one treatments, leaving behind a soft linear ciccatrix.

Patient left for his home March 16, 1906. The supra-pubic wound closed about six weeks thereafter. He has remained free from any evidence of recurrence and is now actively engaged in his profession.

In the treatment of his case strict asepsis was observed, though perhaps in the majority of such cases, as was present here, more or less cystitis exists when they first come under observation.

While the situation of the tumor in this particular case seems especially favorable to this method of treatment, from the fact that the bladder is in a collapsed condition so long as the supra-pubic wound is not closed, almost any point on the bladder wall may be brought within the path the presence of a tube somewhat larger than the one attached to the sleeve of the X-rav tube, which also served

of the light. The incision was prevented from closing by for siphoning off the urine.

The happy results in this case seem to justify the operation of supra-pubic cystotomy at the earliest moment after a diagnosis of tumor of the bladder has been made, the removal of as much of the growth as can be done without serious injury to the bladder, and if malignancy be found, X-ray treatment should be begun as soon as the condition of the wound is such as to allow the tube to be introduced without producing too great pain or hemorrhage.

It is not at all improbable that urine may become itself radio-active as a result of the irradiation and exert an additional curative influence lasting, it may be, longer than the duration of the exposure.

Nothing short of clinical observation, however, can determine this until the peculiar character of radiant energy which produces the physiologic effect be ascertained.

DISCUSSION ON DR. GRAY'S PAPER.

Dr. George C. Johnston, Pittsburg, Pa:—The tube that Dr. Gray employed in this case was probably the only type of tube that could have been employed successfully. I at one time thought that those tubes were no good, but I found that in a small tube the lead glass is fairly safe for the patient, although not for the operator. But I want to call the attention of the society to one thing in connection with these tubes, and that is, that unless you make your exposure about one-half, you will get some surprises. These tubes are exceedingly active, therapeutically, and they have the enviable habit of producing a dermatitis of the second degree about a week before you expect it.

When using these obturators on the skin I use a small leather filter which does away with the dermatitis and does not interfere with the physiologic activity of the rays on the skin or the tissues beneath the skin.

The doctor's result is a brilliant one and I hope that he will report the ultimate outcome of the case at the next meeting, which is really what we want to know.

Dr. Wells, St. Louis, Mo:—This case is very similar from the standpoint of technic to those cases of carcinoma of the mouth and cervix, and it occurs to me to inquire whether Dr. Gray has used the Morton or Caldwell type of cavity tube. If they were practical and durable it would be an especially proper instrument to employ in such a case as this. I have never used them myself, but I would like to know what results may be obtained with them.

Dr. Gray, closing the discussion:—I can substantiate what Dr. Johnston said about the care and use of this particular tube. The first warning I received of anything of the kind was in a case of post-operative treatment of a case of carcinoma of the breast. I had been giving treatments for about two or three weeks without the slightest trace of reaction. The patient presented herself for the next treatment and I found a very pronounced burn of the second degree.

THE TUBE IN ROENTGEN THERAPY.

Ennion G. Williams, M. D., Richmond, Va.

It is not my purpose in this paper to give a complete discussion of the tube, but simply to discuss briefly those points that have have appeared to me to be of the most practical value in therapeutic work.

The factors to be considered are the duration and frequency of the exposure, the distance of the anti-cathode from the surface exposed, the current supplied to the tube, and last, but by no means the least, the character and conditions of the tube itself.

It is within the tube that the measurable electrical energy is transformed into the radiant energy of the Roentgen rays, which is incapable of accurate measurement. The energy or the influence given off from the tube is made up of rays of different physical and physiological properties; and these particular properties are dependent upon the construction of the tube and upon the conditions of the variable factors of the tube at the time the current of electricity is supplied to it.

For a thorough understanding of the tube it is well to review the contruction and the various features about a tube together with their purpose and significance.

The length of a tube is of importance because the farther the external terminals of a tube are apart, the less likely is the current to arc across from one to the other, thereby involving loss of electricity which would otherwise pass through the tube to be transformed into X-rays. This invisible loss of electricity in short tubes may be considerable and render the reading of the milliammeter erroneous so far as it is supposed to measure the electricity transformed. The long tubes, therefore, possess a distinct advantage.

The size of a tube has a decided influence in determining the ease or quickness with which the degree of vacuum changes. The larger the internal capacity of a tube the less influence has a certain amount of absorption or giving off of gas upon the total amount present, or, in other words, the degree of vacuum.

The thickness of the glass opposite the anti-cathode is a very material factor. Glass is very impervious to the

Read by invitation before the 7th Annual meeting of the American Roentgen Ray Society at Niagara Falls, N. Y., August 29 to 31, 1907.

rays and a slight increase in thickness seriously affects the therapeutic efficiency of a tube. When we see a few layers of gauze filter out physiological rays we can realize how much influence even a thin layer of glass can have. The lack of efficiency of some tubes, under apparently the same conditions otherwise, may doubtless be explained by the thickness or quality of the glass opposite the anti-cathode.

The size of the cathode appears to be immaterial. It has been found that aluminum is the best metal with which to construct the cathode because it gives off particles under the electrical discharge less readily than other metals.

The cathode rays are projected in lines perpendicular to the surface of the cathode. The surface of the cathode is made concave and the rays from it would consequently tend to come to a focus at its center of curvature, but the particles composing the rays being similarly charged electrically, are mutually repellant and do not come to a focus until about twice the distance of the center of curvature from the cathode. At this distance is placed the anti-cathode to receive the impact of the cathode rays. By the impact of the material particles composing the cathode stream upon an impenetrable substance is set into activity a series of ether waves known as the X-rays. The anti-cathode is made of platinum because of its density, impenetrability and its high fusing point. The heavier the anti-cathode the heavier the discharge of cathode stream it can stand without the temperature of the metal being raised too high. Since in therapeutic work heavy discharges of the cathode stream are seldom if ever required, it is not necessary to have a very heavy anti-cathode. The anti-cathode should, however, be sufficiently thick to prevent any cathode rays from being lost by penetrating the platinum. The whole efficiency of the cathode stream should be converted into X-rays and given off from the front surface of the anti-cathode.

The cathode and the anti-cathode should be so placed that the line of the cathode stream should be so far from the walls of the tube that it is not interfered with by the strange static influence due to the wall, or by return of the positive particles. This is a possible error that tube makers are not likely to make.

In some tubes the anti-cathode serves as the anode and in others the two are separate. The advantage of these being separate is that in case of reverse discharge there is less disintegration and shooting off of minute particles of

platinum which deposit on the walls and which tend to absorb the gas and so to increase the degree of vacuum. It is, however, better to have the anti-cathode attached to the anode, for it is found that there is in such case greater efficiency to the rays.

The kind of gas within the tube is apparently of no consequence, since they are not atoms or molecules that composed the cathode stream, but sub-atoms or electrons, which are apparently the ultimate subdivisions of matter.

The degree of vacuum or the relative quantity of gas in the tube is the factor of the greatest moment concerning the tube; for that it is which determines the resistance within the tube and this in turn to a great extent determines the penetrative quality of the rays, and at the same time the quantity of electrical energy allowed to pass to be transformed into radiant energy.

In therapeutic work a most important consideration is to estimate the dosage. This can be approximately estimated only when the character of the tube is constant. To maintain a constant vacuum within a tube it is most desirable that a tube used in this class of work should not be subjected to the conditions which are so liable to bring about a change of vacuum, such as the heavy discharges commonly used in radiographic work. The heavy discharges raise very greatly the temperature of the metal of the anti-cathode and also the glass of the tube. This alters the absorption and elimination of the gas contained in metal and glass. The heavy discharges also increase the shooting off of the particles which deposit on the surface of the glass and absorb the gas, thus permanently raising the vacuum.

The regulating devices are, of course, exceedingly useful in maintaining the proper vacuum. They cannot and should not alone be depended upon in the effort to maintain a constant vacuum. This should be done rather by avoiding in therapeutic work heavy currents. My own best therapeutic results have been obtained by using a current of from one-half to one and a half milliamperes, and the resistance in the tube estimated by an equivalent spark gap of from two and a half to six inches. With such a current a tube will maintain a fairly constant vacuum for a comparatively long time and need very little regulating. Should an exposure of more than ten minutes be needed it is well to let the tube have an interval of a few minutes' rest.

It is best to have tubes of different degrees of vacuum than to attempt to regulate the same tube to suit different cases.

As to the physiological actions and the therapeutic uses of tubes of different degrees of penetration, I am in thorough accord with Dr. R. H. Boggs in his article on "The Adjustment of X-Radiations for Various Physiological Effects," published in the St. Louis Medical Review, November 11th, 1905, in which he describes the five degrees of penetration, with their therapeutic indications.

In conclusion: For therapeutic work it is exceedingly desirable to measure the dosage; to do this we must have as constant as possible the factors that are not measurable and to have variable only the factors that are measable. The duration, distance and electrical energy supplied to the tube are measurable, and the conditions of the tube are largely not capable of exact measurement, and therefore they should as far as possible be made constant.

One requisite of a tube for therapeutic work is that the total amount of electrical energy supplied to the tube should be transformed into radiant energy with as little loss as possible. This is accomplished by the following means; first, that the external terminals of the tube should be so far apart that there is a minimum passage of electricity around the tube instead of into it; second, the glass of the tube opposite the anti-cathede should be exceedingly thin, for even the thinnest glass filters out a material amount of therapeutic efficiency; third, the anti-cathode should be made of such material and thickness as to prevent any penetration of the cathode or X-rays, thereby involving a loss of effective rays. This is an almost inconsiderable factor.

The other requisite of a good therapeutic tube is to maintain a constant vacuum. This is accomplished, first, by having the tube of such size that the absorption or elimination of the gas by or from the metal or glass will not greatly alter the relative amount in the tube or the degree of vacuum; second, the electrical discharge sent through the tube should never be so strong that the temperature of the anti-cathode or the glass walls is raised so high as to alter their absorption or elimination of gas.

The tubes used for therapeutic purposes should not be subjected to the heavy discharges common in radiography. The same tubes should not be used for both kinds of work. It is better to have different tubes for the various classes of therapeutic work than to attempt to adjust the same tube to suit every case.

DISCUSSION OF DR. WILLIAMS' PAPER.

Dr. Alfred L. Gray, Richmond Va:—I am heartily in accord with what Dr. Williams has said. I have maintained for a considerable time, and Dr. Williams will agree with me, that the static machine is far preferable for therapeutic work, to the coil. It is very necessary that we should maintain an even vacuum and an even degree of penetration so as to get as little variation in the light as possible. It is a well-known fact that we get a steadier stream of current from a static machine than from a coil. We do not have the powerful discharges that cause these rapid changes in the vacuum of the tube, and it is much less dangerous both to the operator and to the patient.

As to the point brought out of the advantage of having different tubes for different cases, I have had a very striking illustration of that fact recently in the treatment of a case of psoriasis. I at first used for a good while a new tube that I had recently purchased without any marked effect at all on the lesions. With another tube I succeeded in getting a pretty fair tan of the skin, but only slight improvement in the condition. These treatments extended over about two months and I was ready to give up in despair. The patient took a rest for three weeks. Then I determined to try a thinner tube with which I had previously gotten good results in this disease, and in the course of three weeks the psoriasis had entirely disappeared.

This also illustrates the fact that the thickness of the glass is of the utmost importance. The tube with which I got my good effect was made of the very thinnest glass. It was the lightest tube that I had. These points should be borne in mind when we make our selection of tubes.

Dr. William S. Newcomet, Philadelphia:—I want to emphasize one point. I had a tube of certain make that I tried to use on a 110 v coil, but I could do absolutely nothing with it. I tried that same tube on an alternating transformer and found that it worked fairly well. The machine and the tube must balance, although that may not be the correct way of expressing it.

In regard to results with the static machine, I think that the X-ray, is the X-ray, no matter how it is generated. The only difference is how you give it, or how you modify it. You can take a lighter tube and work it on a static machine and get better results than you can with the same tube when it is worked with the coil; in other words, it is a question of the X-ray tube being balanced to its generation. I agree with Dr. Williams in everything he said in his paper.

Dr. Mihran K. Kassabian, Philadelphia:—I agree with Dr. Newcomet that the X-rays are the X-rays no matter how they are generated, but they differ in their quality and quantity. It has been proved that with an increase in the size of the cathodes we get more rays. It has also been proved that by making a tube with two

cathodes, opposite to each other, the one being twice as large as the other, a plate exposed to the larger of the two cathodes is made in half the time as is the plate exposed to the smaller. Therefore, the form, size and shape of the cathode has much to do with the production of the X-rays.

ABSTRACT.

RULE AS TO NEGLIGENCE IN X-RAY TREATMENT.

Henry Winthrop Hardon, A. M., LL.B.

Medical Record, March 16, 1907.

In February of this year a case was brought to trial before Judge Brady and a jury in the Supreme Court of New York in which a well-known physician was charged with negligence in that he "unskillfully, carelessly, and negligently administered to the plaintiff what is commonly called or known as X-ray treatment. The case was left to the jury, who found a verdict for the defendant.

The Facts.—The plaintiff, about thirty-five years of age, had had an operation for tuberculous glands on the right side of her neck. A large scar, with considerable loss of tissue, marked this operation. Subsequently, the glands on the left side of her neck were similarly affected, and she applied at a hospital for treatment, but refused an operation. She was then advised that X-ray treatment for this malady was often successful, and in the spring of 1903 she applied to a physician for that treatment. After several applications, he noticed on one occasion when she visited his office that she had developed a slight dermatitis. He then suspended treatment for about two weeks. Shortly after, and while still under treatment by this physician, she applied to the defendant for X-ray treatment, and during May, 1903, the two physicians treated her contemporaneously, each remaining in ignorance of the other's treatment.

In the fall of 1903 she had three treatments from the defendant at intervals of about ten days. A 16-plate Waite & Barlett machine was used with a 5-inch General Electric tube. The surface of the tube was not less than 8 inches from the plaintiff's neck, and the exposure on each occasion lasted 8 minutes. Her head and shoulder were protected by sheets of lead foil, with an aggregate thickness of about 1-12-inch. Four or five days after the third treatment a dermatitis of the second degree began to develop, extending from the bottom of the neck to above the ear, and embracing the whole left cheek. She called on the defendant, who prescribed an antiseptic dressing and urged her to call again in a day or two. He saw her only once more, about ten days later, when the wound was purulent and dirty, and the hair about the ear had fallen.

At the time of the trial she had a network of telangiectases over the glands in her neck and extending into her cheek, and a slight sclerosis behind the ear. Her hair had grown again. The glands were still slightly enlarged on both sides of the neck. She had been examined in October, 1904, after suit began, and it appeared that the telangiectases had increased considerably since that time. She had had further X-ray treatment *from a third physician* in the interval.

The Expert Evidence.—The evidence of experts on both sides was that the duration of the treatment and the distance of the tube from the neck was regarded as safe, that the static machine was deemed safer than a coil, that the quantity and quality of the X-ray continually varied, not merely from day to day, but in the course of a single application, that the protection by a lead sheath was the

best known to science, and that *no means was known to science of accurately measuring either the quantity or quality of the X-ray.*

The Law.—On this state of facts, the Judge charged the jury upon the question of the physician's duty according to the familiar rule. (*Pike v. Honsinger,* 155 N. Y. 201). First, he must possess "only that reasonable degree of learning and skill relating to X-ray treatment commonly belonging to a physician and surgeon using that treatment in the city of New York, in November, 1903." Second, he must use "only reasonable care and diligence in the exercise of his skill and the application of his learning in the treatment by X-ray." Third, he was bound to treat the plaintiff "according to his best judgment." The Judge pointed out that the defendant was here charged with negligence or breach of duty only in the actual treatment, the second branch of the duty imposed on him by law, as above defined. The possession of adequate skill and learning, and the exercise of best judgment were thus not in the case. Reasonable care and diligence in the treatment meant "such ordinary care and diligence as is usually given by a physician in good standing. It does not mean the highest possible care and diligence, or such care and diligence as might have been used by some other physician, or even by the defendant himself." The physician is not an insurer or guarantor, and "*in X-ray he does not insure the patient against a burn.*"

The part of the charge of chief significance, however, was that in which the Judge dealt with the doctrine known as *res ipsa loquitur.* Briefly stated, that doctrine means that the accident and the surrounding circumstances speak for themselves, and afford *prima facie* proof of negligence. A common instance of the application of the doctrine is found in a railroad collision between two trains. The Court knows, and everybody knows, that when trains are operated with ordinary and reasonable care they do not collide, and the mere fact of a collision, therefore, affords evidence of negligence; the accident speaks for itself. But the Court here holds that the mere happening of an X-ray burn is not evidence of negligence, and it reached that conclusion doubtless in view of the evidence of the uncertain state of X-ray science. The Judge charged as follows: "If the jury find that the plaintiff received the burn of which she complains in consequence of the treatment by the defendant, they cannot infer that the defendant was negligent merely because the plaintiff afterwards suffered from X-ray burn, for the cause of the burn may be beyond human knowledge, and even expert experience may not be sufficiently uniform to indicate a sure means of preventing it. Owing to the limitations of human knowledge, the exercise of every reasonable care does not always prevent accidents, and this is especially true in dealing with such comparatively little known forces as electricity and X-rays. The jury cannot find the defendant guilty of the negligence alleged in the complaint unless it can find in the proofs some particular act of negligence which caused the burn. To punish the defendant because he cannot explain the cause of the burn is not necessarily to punish him because he has done wrong, but may be to punish him because he does not know something which science cannot find out, or has thus far been unable to find out. That would be manifestly unfair, and the law will not do it."

APRIL, 1907

AMERICAN QUARTERLY OF ROENTGENOLOGY

PUBLISHED BY THE AMERICAN ROENTGEN RAY SOCIETY

Volume I. No. 3

Next Annual Meeting
Cincinnati

October 2nd, 3rd
and 4th, 1907.

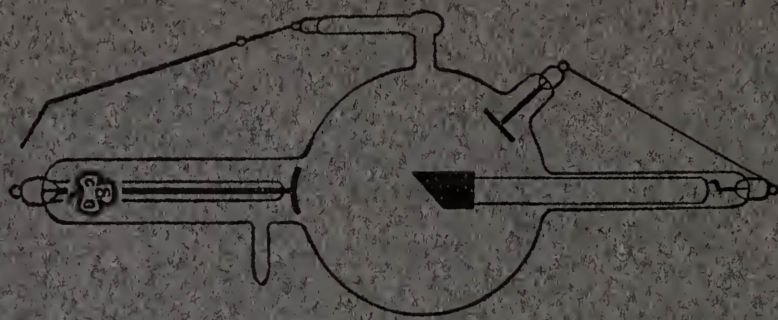
ONE DOLLAR
PER COPY

THREE DOLLARS
PER YEAR

PRESTON M. HICKEY, M. D. Editor
32 West Adams St., Detroit, Mich.

GEORGE C. JOHNSTON, M. D., Managing Editor,
611 Fulton Building, Pittsburg, Pa.

H. W. DATCHELER, Advertising Manager,
237 Michigan St., Toledo, O.



American Quarterly of Roentgenology.

Published by the American Roentgen Ray Society.

Business Office, 611 Fulton Building, Pittsburg, Pa.

American Quarterly of Roentgenology.

Published by The American Roentgen Ray Society.

CONTENTS

APPLICATION FOR MEMBERSHIP
IN
THE AMERICAN ROENTGEN RAY SOCIETY

I, ..., hereby make application for membership in

THE AMERICAN ROENTGEN RAY SOCIETY

I am ....of age. I was born at .... and now reside at ....

....I am a graduate of ....

from which I hold the following degrees; ....

....

My occupation at present is that of ....

I am now a member in good standing of the following learned societies:

....

....

Signature..

We, members in good standing of THE AMERICAN ROENTGEN RAY SOCIETY, consider

....to be well qualified to become a good and useful member of the Society, and recommend that...be received.

Signature..

Signature..

The Executive Committee hereby approves the above application.

Signature..

Signature..

Signature..

ANNOUNCEMENT

The next meeting of the American Roentgen Ray Society will be held in Cincinnati, October 3rd, 4th, and 5th, at the Grand Hotel.

The Grand Hotel is located on the south-west corner of Fourth Street and Central Avenue, and so is within a few blocks of the most important shopping district. The Hotel extends from Fourth to Third Street, and its Third Street entrance is directly opposite the Union Station which the B & O , C & O , and Big Four (New York Central) use. The L & N does also upon the request of passengers. The Pennsylvania, Erie, and C H & D arrive at other terminals but street cars connect these directly with the Grand Hotel.

Arrangements have been made whereby the Convention Hall, the Exhibit and board and rooms for the members are furnished under one spacious roof. There will be ample accommodation for all upon either the European or the American plan. The rates for the latter will be three dollars a day up.

This is a very large and well appointed hostelry, which is able and anxious to afford the Convention every accommodation.

Lantern slides are expected to be an important feature and every arrangement for this has been made. The lantern is of the best and the hall can be perfectly darkened.

Any suggestions from members which are intended to add to the success of the Convention, or to the comfort or pleasure of those attending can be sent to

Dr. Kennon Dunham,
2503 Auburn Ave.,
Cincinnati, Ohio.

EDITORIAL DEPARTMENT

At the recent meeting of the American Medical Association at Atlantic City there was presented a most interesting exhibit of roentgenograms under the auspices of the Philadelphia Roentgen Society. The exhibit was a decided success, and attracted much attention. While it embraced a variety of subjects, it was along distinct educational lines and served to demonstrate to the profession many of the diagnostic uses of the Ray. Great credit is due to the Philadelphia Roentgen Society for the labor and enthusiasm, which brought together and properly exhibited such a fine display of negatives. All X-Ray workers should give thanks to Doctors Leonard. Newcomet and Smith, the committee in charge. It is to be hoped that at successive meetings of the American Medical Association similar exhibits may be held, which will bring forcibly to the attention of the profession the constantly widening field of the Roentgen Ray in diagnosis.

In the collection of negatives the critical observer found much to praise and little to condemn. The great majority of the diagnostic plates were, from a technical standpoint, of distinct merit, a few plates showed lack of penetration, insufficient exposure, overdevelopment; a somewhat larger number showed lack of immobilization of a part under examination, with the consequent loss of fine detail. Comparison of this exhibit with exhibits of our Society in former years show, however, that the technical skill of the workers is constantly increasing and the results consequently are much more accurate. A pleasing feature of the exhibit was the fact that it brought together those interested in this subject, and almost any time while the room was open little groups of interested observers could be seen in earnest discussion over different plates. In this way the demonstration was of the utmost value to those directly interested in this subject, as well as to the general profession.

In a recent conversation with a prominent member of our Society, the inconvenience of our present nomenclature was touched upon. The trouble of properly pronouncing such words as "Roentgenogram,"

"Roentgenography," etc., is indeed a matter to be deplored. If the American Roentgen Ray Society could devise a nomenclature which would be properly expressive but less cumbersome it would indeed be a work which would be welcomed with joy by those who have constantly to use these terms.

The value of the time and temperature method of development does not seem to be sufficiently recognized by those engaged in Roentgenology. In photography proper it has been conclusively demonstrated that a normal developer at certain temperatures gives the best results when allowed to act upon the plate for the normal time. Many X-Ray workers think it necessary to watch the plate constantly during the process of development; however, every time a plate is lifted from the solution and examined, there is a certain amount of fogging takes place, with the additional risk of damage to the sensitive film. The photographic experts of the world have shown that after development has once started it is impossible to influence the end result by any change of solution. It would be gratifying if some of the workers of our Society would take up this question, and, by a series of experiments, show whether the final plate is influenced at all by other factors than the exposure.

In a certain section of the country there exists a small society of three Roentgen Ray workers who live in adjacent cities. Once a month they hold a half day meeting at which the plates which have been taken since previous meetings are displayed and discussed with demonstrations of new wrinkles in technique. This little society has been found to be of the utmost value to its three members, and the interest has been unabated for over a period of two years, so much so that practically nothing is allowed to deter a member from attending. In various cities the frequent meetings of the medical societies furnish great stimulus to the members of the medical profession. To those interested in special work the value of the opportunity of discussion of technical points is very considerable, and furnishes a stimulus which should not be despised.

Through the generosity of the Philadelphia Roentgen Society the frames used in the Atlantic City exhibit have been donated for the annual meeting at Cincinnati. This will allow of a considerable number of negatives being shown and will permit the exhibit committee to extend somewhat the scope of the original plan as outlined in the last number of the Quarterly. Owing to the

departure of Mr. Dachtler to Europe for study and recreation, Dr. Percy Brown, of Boston, has been made chairman of the exhibit committee.

A CORRECTION

June 11, 1907.

To the American Quarterly of Roentgenology:

I desire to make a correction. The criticism made upon Dr. Coakley's paper on page 34, vol. 1, No. 2 in the discussion of Dr. Caldwell's paper upon the Accessory Sinuses, I find to be unjust, since in his paper upon this subject in the "Annals of Otology, Rhinology and Laryngology, March 5, 1905. I find that he gives due credit to Dr. Caldwell for his work.

Yours very truly,

G. E. Pfahler.

RADIOGRAPHIC EXAMINATION OF THE STOMACH.

The entire first number of ''Mitterlungen aus dem Laboratorium fur radiologische Diagnostik and Therapie in k. k. algemeinen Kraukenhaus in Wien,'' issued by Dr. Guido Holzknecht, is devoted to a series of six rather exhaustive articles dealing with the application of Roentgen rays to the diagnosis of those thousand diseases which are accompanied by distinct changes in the size, shape, position or character of the peristaltic waves in the stomach.

The first article by Holzknecht and Brauner deals with the general method adopted by them in the employment of Roentgen rays in examination of the stomach. The article is illustrated by numerous cuts illustrating the method employed by them and showing typical fluoroscopic pictures illustrating the appearance of the stomach in different positions and in various stages during the fluoroscopic examination.

The authors make use of the well-known fact that the different parts of the digestive tract have the same degree of permeability to Roentgen rays and that this permeability is for all practical purposes the same as that of most of the surrounding tissues and that therefore it is necessary in the examination of any one organ or part of the alimentary canal to render this particular part either more permeable or less permeable to the rays than the surrounding organs or tissues. They have found the latter more practical and more readily accomplished and employ for this purpose bismuth in the form of capsules containing 2 grains. The operator and patient are protected by a large lead screen having an opening behind which the tube is placed and the patient stands in front of the tube so that the region to be examined is oppoiste the opening in the lead screen. The patient then swallows the bismuth capsule and the movements, position, etc., assumed by the bismuth capsule

is followed upon the fluoroscope. By means of a table covered with lead sheeting containing a diaphragm opening beneath which the tube is placed the patient can be examined in various recumbent positions.

The chief feature of the author's article seems to be in the clearness with which they have brought out the advantages of the fluoroscopic over the skiagraphic method of examination, giving as this method does a continuous picture for periods varying from a few minutes to several hours and making possible the examination in practically all positions. The examination can also be made with an empty stomach, a stomach distended by gas or filled by a full meal.

The second article by Holzknecht and Jonas deals with the diagnosis of constricting tumors of the pylorus by the radiologic method. The stomach is first washed out and the patient is then given a quantity of gruel containing 2 grains or more of bismuth subnitrate and the fluoroscopic examination made in various positions. In tumors causing pyloric constriction or narrowing with the dilatation of the stomach the bismuth fills the lower part of the stomach, leaving the pyloric pole empty when examined in the erect posture. When the patient lies on his right side the pyloric position is entirely filled and the cardiac end may appear empty. The change of position of the bismuth with changes of the patient's position shows that even when the pyloric position is filled with the bismuth gruel it is unable to pass into the duodenum. These findings controlled by other chemical findings are very useful in making a diagnosis in suspected cases of cancer of the pylorus.

The third article by Kaufman and Holzknecht is a Roentgen ray study of the peristaltic waves in the pyloric portion of the stomach. By administering the bismuth gruel and observing the stomach on the screen for some time the peristaltic waves can be distinctly made out moving along the greater curvature toward the pyloric position of the stomach. The presence of tumors involving the greater curvature may so modify there peristaltic waves that the changes in the character and direction of the waves may have important diagnostic value.

The last two articles by Holzknecht deal with the application of the Roentgen method to the determination of the form, size and location of the normal stomach. Holzknecht concludes from his examinations by this method that in the majority of adults evidences of gartroptosis in a greater or less degree are present, and that in a majority of adults we may properly speak of a ptosis of the stomach as the condition found. In this he agrees with Virchow, who said in 1890 that in the majority of all adults a certain degree of dislocation of the abdominal organs, especially the stomach and intestines is found at autopsy, and that far more persons are affected with this dislocation of the abdominal organs than have a normal location of the abdominal viscera.

Doubtless this application of the Roentgen method of examination of the stomach and intestines has many advantages over the method of making plates. It is, however, extremely tedious of application and the information it gives is no more accurate in many conditions than that given by other clinical methods less time consuming and more easy and agreeable in application both to the patient and the physician. In certain doubtful cases where the ordinary clinical methods give uncertain results or are not otherwise applicable the radiologic method should be tried. Chief among these conditions might be mentioned hour glass contraction of the stomach, tumors of the pylorus and tumors involving the greater curvature.

JOSEPH F. SMITH.

AMERICAN
Quarterly of Roentgenology

Volume I APRIL, 1907 Number 3

THE STANDARDISATION OF RADIATIONS.

By CHARLES E. S. PHILLIPS, Ph. D.
London, England.

I have accepted with great pleasure the invitation with which you have honoured me, to send in a paper dealing with the question of the standardisation of radiations.

The need for a measure of radioactivity and the demand for a unit in terms of which to express the radiation from an X-ray bulb are becoming pressing.

Every investigator finds it necessary to set up an arbitrary standard of his own for experimental work, involving the knowledge of the relative activity of a number of substances. And the medical practitioner especially requires that an agreement should be come to regarding a method for the comparison of those rays which are found so beneficial in the treatment of disease.

The question, however, is full of difficulties and physicians have delayed in dealing with it on account of uncertainty as to the best property of the radiations to select for the measure of their effectiveness.

In the meanwhile certain rough methods have arisen for the comparison more especially of specimens of radium.

Now, the desirability of repeating and extending in one laboratory the results announced from another is often of the greatest importance, and especially is it necessary that a medical man may be able to define the conditions of treatment with radiations so that his work may benefit as wide a circle as possible. And again there is also the commercial aspect of the problem. To purchase an expensive sample of radium bromide entirely on the assurance of the dealer as to its merit is, to state the case as politely as possible, thrusting too much responsibility upon him.

There have been occasions already when the dealer's mistake has somewhat discouraged his client.

The public is required to pay large sums for a quality which it has no accurate means of estimating.

How are we to know when buying radium that we have our money's worth?

The Röentgen Society of London has for some months past been aware of this anomaly and now asks the help of all interested in the matter to assist toward formulating a standard in terms of which the activity of substances may be expressed with accuracy, and one by which the radiations from a focus tube can also be estimated.

And the Society, fully appreciating the intricate nature of the inquiry, has appointed a committee to collect information and to digest any suggestions which may be sent from physicians and others interested in the proposal.

It is not possible to predict thus early in the work whether the committee will be in a position, by the spring of next year, to submit a complete system of measurement which will be acceptable to those in all parts of the world who are engaged upon radioactive or X-ray work, but it is hoped that by then at least some useful progress will have been made toward that end.

I need therefore hardly say that any suggestion upon the subject which may come from your Society as a whole as well as any scheme or idea which a member may individually be so good as to send the committee, will be gratefully acknowledged and carefully considered.

The problem may be looked at from at least two main standpoints. namely, that of the X-ray worker and that of him whose investigations lie among radioactive bodies.

If we choose X-rays as the particular type for standardisation, a large number of factors enter into the problem.

To make an X-ray apparatus, for instance, which shall give off a definite pencil of rays under given conditions would be difficult enough. Moreover, if to measure the activity of a piece of radium it were necessary to set in action the standard X-ray bulb for comparison we see how undesirable is the notion. Nevertheless, while deprecating a multiplicity of units, the problem is being actively attacked by the X-ray expert and a compromise arrived at by standardising not the rays themselves, but an electroscope to be used as a meter. Each instrument maker will presumably have his own view as to the best design for his particular standard electroscope, and the number of so-called standards of radioactivity will be legion. The only thing in favour of this idea appears to be the attention it

has called to the whole subject and to the need for immediate action on the part of those who desire to place the standardisation of radiations upon a sound basis with the least possible delay. Let us start rather from the other standpoint and postulate a standard pencil of rays emitted constantly by a substance.

Having chosen ionisation, say, as the property in terms of which the arbitrary unit is to be established, we may express at once the activity of an X-ray bulb by a direct comparison in a suitable apparatus If, for instance, we standardize the gamma rays from radium, the ionisation produced may be directly compared with that given by X-rays after applying a correction for the absorption of the rays by air in each case. The radio-active standard would be small, easily managed and not necessarily expensive. Anyone possessing a copy of the unit could calibrate his own electroscope in a short time, or, if he prefer, might use a *differential* electroscope and adopt a zero method. The *standardisation* of electroscopes will never make for real progress in this question, even though it may certainly be of some temporary utility for the rough comparison of X-ray bulbs.

The recent work of Prof. Rutherford makes it appear undesirable to use radium as the source from which we are to obtain the rays for standardisation, because its radioactivity does not appear to be sufficiently constant.

It has been suggested that uranium be chosen, and that two units be set up of different strengths, one utilising the rays from uranium and the other for practical everyday use, those from radium. Thorium, too, has been suggested.

Assuming that a constantly emitting substance is discovered, the selection of a definite property for the measurement still remains.

There are many questions to consider.

A unit of radioactivity is required by science and commerce alike, and there is surely good reason for believing that a suitable one can be devised.

I venture to think that it must be the essence of our undertaking to frame the standard upon as broad a basis as possible. C. E. S. P.

Discussion on paper by Mr. Phillips.

Dr. Charles Lester Leonard, Philadelphia: We must certainly agree with Mr. Phillips that a uniform standard and method of measuring all forms of radiant energy would be of the utmost scientific and practical value. We must also endorse the broad-minded manner in which this subject has been approached by the London Roentgen Society. Their committee is made up of men whose names are standards of worth in science and their appeal must ring true in the hearts of the members of this society. The object of this society is to further the scientific employment of the Roentgen ray in every possible manner, and in no way can we do more than by aiding this committee in its work. Both individually and collectively we are asked to assist, and I hope the response will be a generous one, for I feel that we can render valuable assistance if the proper effort is made. There should be serious discussion of this subject, and it should not stop with this meeting, but each individual should keep it in mind and send his best thoughts and suggestions to this committee.

All the various forms of energy that are utilized in the sciences and arts, in mechanics and in industrial work, all energy that accomplishes work is measured in standard units. These units vary widely as to whether they measure the chemical action of light photographically or the powers of Niagara developed in kilowatts. The measurement of energy produced under known conditions in standard units is universal. Radiant energy is capable of measurement, but the standard by which such measurement is to be made has not yet been decided on. When this has been accomplished, a universal language wiil, as it were, be provided for the interchange of thought and, practically, for standardizing and evaluating the various agencies capable of producing radiant energy. The problems for decision have been clearly stated by Mr. Phillips, but the principal problem, so far as we are concerned, is whether that unit shall be a minimum with high multiples to express the maximum, or whether it shall be a medium unit like the grain, with lesser divisions like the centi and milligram, and greater, like the kilogram.

This question is one of particular importance to the Roentgen Ray worker from a practical standpoint. It has been practically decided that the ionizing power of radiant energy is the factor by which it can be most readily and accurately measured. It is comprehensive in its scope and includes all powers of radiant energy possessing this power. It is possible to adopt a standard unit which can be expressed in definite terms without referring that standard to a definite physical object or standard radiating substance. We are still in the dawn of knowledge regarding radiant energy and radiant matter. We cannot see clearly its true nature. Even the supposedly immutable radium has been shown lately, by Rutherford, to be subject to change. In setting an arbitrary standard for the use of the human intellect, why strive to find one that is immutable, in this world of change? The finite is all that our intellects are capable of comprehending, or our work-a-day world of utilizing. Why try to express in definite terms that approximate infinite accuracy, that which at best must be expressed in terms of the unknowable? Why complicate our ignorance by attempting to measure the unknown in terms of other unknowables?

The discoverer of the X-ray showed his wisdom and his respect for the unknowable by giving the rays the name of the unknown X. That wise forethought has been justified by the limited increase in

knowledge regarding them that science has been able to make in the last decade. Their radiant energy and that of all radiant matter may be measured in terms of one of the properties he described, the ionizing power. This method of measurement is one of the most accurate known to science, and is adaptable through the electroscope to all radiations. A standard mass of radiant matter capable of producing a given amount of ionization in a given time is not necessary or even possible to attain. A quart of water might as well be said to be the amount that would pass through an opening one centimeter in diameter, under a given pressure, in a given length of time, under standard conditions of barometer and temperature.

Electrical units are definitely known and determinable. The electroscope is an instrument capable of standardization and of repeated definite measurement. Why should not a unit be adopted that can be expressed in these known and commonly employed terms? A unit of ionization will then be the unit quantity of electricity (to be determined) passing across a unit gap, in unit time, under the influence of radiations at unit distance under standard conditions of barometer and temperature. The quantity of electricity; the size of the terminals; the distance between them at the gap; the unit of time; the distance of the source of the radiant energy, and the standard electroscope and its unit reading are the things to be determined by this committee. Such a standard method of measurement would be applicable to all forms of radiant energy. If necessary, the distance or time factors could be varied proportionately, so that rapid measurement of the weaker and stronger sources of radiant energy could be measured readily with the same instrument. The electroscopes could be standardized by comparison with a standard instrument and certificates of accuracy granted. By this method a working standard would be obtained which would express in known terms now commonly in use measurements of the unknown energy we employ, one that would have a capacity for variation that would adapt it to the weakest as well as to the most powerful sources of energy.

NOTE RELATIVE TO THE ESTIMATION OF ROENTGEN DOSAGE.

By Henry G. Piffard, M. D., New York, N. Y.

I use the term estimation in preference to measurement, as there does not exist at the present time, so far as known to me, any method by means of which the quantity of X-rays delivered, and their biological effects, can be directly measured.

Numerous methods, however, are at command whereby certain physical and chemical phenomena may be measured and their effects on the tissues estimated with more or less accuracy. The most thorough discussion of the various methods already proposed, that I know of, will be found in articles by Bordier (of Lyon), H. Lewis Jones (London), Kienbock (Vienna), Hall-Edwards (Birmingham), and Reus (Chemoga), contained in the June issue of the *"Archives of the Roentgen Ray."*

Holtzknecht's method is the one that certainly has been exploited the most, but is now very generally discredited. Sabauraud and Noire used little pastilles of platino-cyanide of barium, which under the influence of the rays change from green to yellow and finally to orange; and from all accounts this device gives perfect satisfaction in the city of its birth. One objection to it, however, is the fact that to use it effectively necessitates a small tube whose diameter does not exceed four inches. Bordier also employs the platino-cyanide as an indicator, but has greatly improved on the Sabauraud device in so much as with his pastilles a tube of any size may be used, and he has a comparative color scale of five tints, ranging from a faint trace of yellow to deep orange.

The change in the color of the platino-cyanide is due to dehydration of the salt under the influence of the rays and without doubt works well when the atmospheric humidity is low. A warning, however, comes from London, as the damp atmosphere of that city so hinders the color changes that a dangerous over-exposure is liable to occur if the test color is relied on. My personal experience last summer tends to confirm these findings. This summer the Bordier pastilles reached me about the middle of July and I immediately made a test with an exposure that certainly would have resulted in a severe burn of the third degree, and yet the color change would simply indicate the mild erythema. A similar test was made with radium, and with the same result. I then heated one of the pastilles so as, in a measure, to dehydrate it, and the color change was very decided. I feel justified, therefore,

in concluding that the platino-cyanide indicators cannot be safely used in New York City during the summer season, when for eight or ten weeks the relative humidity rarely falls below 80 degrees and often runs up to 90 degrees or more.

There is still another objection to the platino-cyanide, as the color change must be examined by daylight, not by artificial light.

It occurred to me a few weeks since to measure the intensity of the electro-static field surrounding a Crookes tube during an exposure, thinking that it might possibly be a convenient means of estimating the energy that was being given off.

To do this, I took a brass ball about one and one-quarter inches in diameter and supported it about four inches from the wall of the tube and just within the circle of the rays issuing from the anterior hemisphere. The ball was then connected by a conducting cord about eight feet long to the charging device of an electroscope. As soon as the current passed through the tube, the aluminum needle or foil indicated the charge, and the angle was easily read off on the scale.

For this purpose, I found both Braun's electroscope, which is graduated in volts, or the writer's, which is graduated in degrees of an arc, very convenient, and I found that the angle varied directly with the current passing through the tube. It further showed whether the tube was running steadily or not, and also indicated any notable change in the vacuum.

I have not yet been able to give the matter a thorough therapeutic test, in so much as I am not a frequent user of X-rays, and I present the matter now as a preliminary note, in order that those who use the rays more frequently may ascertain its practical value in this connection.

P. S.—Since the foregoing was written I have received the August number of the *"Archives of Physiological Therapy,"* and in it find an article by Columbo which fully bears out my own conclusions as to the unreliability of the platino-cyanide methods, and I also find, somewhat to my surprise, that others have experimented with the electro-static field, but the details are not as yet known to me. It is more than possible, therefore, that the foreign technics may be superior to my own.

A NEW DIRECT READING X-RAY METER.

Geo. C. Johnston, M. D., Pittsburg, Pa.

Ever since Roentgen discovered the existence of the invisible form of wave length, since known by his name, efforts have been made to devise a means whereby a measurement could be obtained of the quality and quantity of rays emitted from the excited Crookes tube. With these attempts at measurement, this Society is familiar, but I shall enumerate them briefly, calling attention to the virtues and defects of each.

First: Holzknecht's Chromoradiometer. This consists of a quantity of potash salts mixed with copal varnish inclosed in a celluloid capsule. As furnished to the operator this capsule is about the color of the varnish, a dirty yellow, but under the influence of the rays, it changes in color, becomes finally green. There is furnished with the capsule a scale of shades of green, divided into 11 spaces. The reagent having been exposed to the ray, is moved along the scale until a point is found where its tint matches a tint upon the scale. Thus, if tint 4 of the scale matches the tint of the capsule, the surface upon which the capsule was placed during the exposure is said to have received 4 units. H. Holzknecht claims that by the use of this re-agent an exact dose may be given and precisely the degree of reaction prescribed and pre-determined will follow. It seems, however, that this method is not free from error, and I possess a dim recollection of one case where the result was so disastrous as to result in the assessment of punitive damages at the hands of an unappreciative court. These capsules having once been used, regain their color upon exposure to light, but must never be used again.

This method takes no account of idiosyncrasy; in fact, it ignores it, whereas every operator of experience knows that frequently an individual is met with, possessing such peculiar susceptibility to the undesirable effects of the ray as to render him an object of concern to the peace of mind of the Roentgenologist.

The unit H. is defined as that quantity of X-ray, exactly capable of producing a certain reaction upon living tissues. Such a unit is inexact and unscientific and should be replaced by one founded upon definite chemical action as evidenced by the amount of a known salt (in solution or otherwise) decomposed by exposure to the ray, all other decomposing factors being carefully eliminated, or better by a C. G. S. unit founded upon the equivalent heat value of the ray when so transformed.

Freund's method consists in estimating the amount of free iodine liberated by the ray when a solution of iodoform in chloroform is exposed to the ray. This reagent being sensitive to light must be employed in non-actinic containers and the amount of iodoform liberated determined by means of quantitive analysis. This is a very exact method of telling what you have done, after you have done it.

Sabouraud makes use of the platino-cyanide of barium, made into little wafers pasted on paper. The cyanide, upon exposure to the ray, changes from apple green through red, brown to maroon. With these pastilles is furnished one which has been exposed to a certain quantity of radiation corresponding to the maximum dose of X-ray which it is safe to apply to a healthy skin of a normal patient and which is just enough to produce a temporary epilation but not enough to give rise to a dermatitis. This device is particularly intended for use in the treatment of sycosis and other diseases where a quick, painless epilation is desired. The pastille must be placed not on the patient's skin, but at a distance of eight centimeters from the anti-cathode. In some tubes, however, this would necessitate placing the pastille on the surface of the tube, or even inside the tube, and with such a tube, the pastille is so close that it is acted upon by radiant heat from the tube, which will promptly produce the same change of color as the X-ray. These pastilles must never be used for the second exposure, although they do regain their color when placed in the light and where they may absorb moisture

Kohler attempted to measure X-ray by means of a thermometer in the wall of the tube. This method does not need discussion in order to condemn it, as no one has ever proved any relation between the heat and the X-ray emitted through any given tube.

Kienbock places on the surface under treatment a piece of photographer's paper enclosed in a non-actinic envelope. After the patient has been treated or at any time during the treatment the jacket is removed; the slip of paper is developed and compared with the color scale. This method is accurate if the same sensitometer test paper is always used, if it be developed immediately following the exposure in the same developer. at the same temperature, for the same length of time, washed and hypoed for the same length of time, and always examined either dry or wet. But it introduces a personal equation in that the developed slip must be compared with a graduated scale of tints, thereby permitting of great error.

Guilleminot compares the illumination of a fluorescent screen under the action of a sample of radium of known strength with that of a screen exposed to the influence of an X-ray tube, and measures the square of the distance of the screen from the tube necessary to produce equal illumination. Anyone who has tried to compare the fluorescence of two screens under different illumination or who has ever made any photometric readings, will appreciate the possibility of gross error in this proceeding.

Bordier uses platino cyanide of barium made into a pastille, the back of which is adhesive and is to be attached to the skin over the part under treatment. There is supplied with these pastilles a color scale having four tints; No. 1 a dull yellowish green. This is exactly the shade that the pastille will take when it has been exposed to the maximum dose of X-rays compatible with the complete integrity of the normal skin. With this dose, the hair falls out 20 days after the exposure, but grows again in another 20 days and no reaction is present unless a very low tube is used. Other shades correspond to increasing doses of the ray.

The milliampere-meter when placed in series with the X-ray tube is of great value when in the hands of an expert employing it with a tube with the working of which experience has made him thoroughly familiar. But it is necessarily an exact measurement of the current flowing in the tube circuit and nothing more. And when one or a series of valve tubes is employed in the circuit, it is not even a measurement of the internal resistance of the tube. I have one tube which gives a beautiful fluorescence and backs up a spark-gap of two inches. Yet when taking a current of two and one-half milliamperes, it gives off no X-rays whatever; at least none that can be detected by means of a fluoroscope. With a normal tube, however, and a coil that is free from inverse discharge, it is a very valuable instrument, especially when making quick exposures with heavy currents in radiography.

The meter which I have devised resembles these described in no respect. In my device a direct reading is given by a pointer moving over a graduated scale, the movement of the pointer being in direct relation with the quantity of one quality of radiation, and that the most important emitted from the tube. What I measure is the quantity of rays which have the power of rendering fluorescent certain salts, such as barium platino cyanide, tungstate of calcium and others. These rays are the so-called X-rays, and while there are undoubtedly many other forms

of radiation emitted from an X-ray tube when in action, yet it is sufficient for the purpose that we are able to measure accurately, continuously and safely the X-rays alone. This is accomplished by means of the following device.

It is well known that when the X-rays strike upon particles of certain salts, tungstate of calcium, for example, these salts if observed in darkness, may be seen to become brilliantly luminous or fluorescent, and this fluorescence bears a constant ratio to the intensity of the rays and to the distance from the point of emission of the ray, as they, in common with all forms of wave length emitted from a point, fall off as the square of the distance.

Now it has been customary among X-ray workers since the discovery to judge the amount and the quality of the X-ray emitted from any tube when in action by observing this power of the ray in inducing fluorescence, by means of a screen coated with crystals of tungstate of calcium or other salt and made part of a light-tight box, having an aperture for the eyes of the observer, such contrivance bearing the name of a fluoroscope.

Estimations of the power of penetration of the ray were made by holding behind the screen in the path of the rays various objects (usually the hand of the observer), and this practice was responsible for serious injuries, loss of fingers, hands and lives, since the repeated exposure of the operator's person to the ray resulted sooner or later in peculiar ulcerations miscalled X-ray burns, but in spite of this danger this method is persistently followed at present because experience has shown that it is the best way of actually determining the quality and quantity of invisible radiations emitted from the tube. In place of the observer's hands various other objects possessing a variation in the degree of opacity to X-rays have been substituted and are used for such observation, but the readings are inaccurate. They require, since they are made in the dark, that the observer's eye should be accustomed to the darkness, hence their accuracy depends upon the condition of the observer's eyes at the time the reading is made, and no two observers will read the same degree of penetration.

In my invention the fluorescence induced or produced upon a tungstate of calcium or other screen is employed as indicating the quantity of the X-rays emitted. The fluorescent screen is placed in a light-tight box or container. Facing the fluorescent screen is placed a selenium cell, which cell, as is well known, has the property of changing its ohmic resistance to the passage of electrical currents with relation to the presence or absence of light waves.

Such a cell when kept in total darkness protected from light of all kinds may have a resistance of several hundred ohms, yet upon permitting light, natural or artificial, to strike upon the cell, its ohmic resistance falls almost instantly to a great degree and the variation in ohmic resistance thus produced bears a direct relation to the intensity of the light.

If, therefore, there be placed in series with such a cell as described a galvanometer or ammeter of sufficient delicacy, a source of electrical current such as an ordinary so-called dry battery, a variable rheostat providing a means of introducing more or less ohmic resistance into the circuit, and the rheostat, the measuring instrument, and the selenium cell be balanced a point will be found at which the ohmic resistance of the rheostat, the connecting wires, the selenium cell and the measuring instrument will exactly balance the electro-motive force of the battery cell and no current passing, the measuring instrument (galvanometer or milli-ammeter) will stand at zero.

If now, however, the container having within it the screen and the selenium cell be placed in the path of the X-rays proceeding from an excited X-ray tube, the screen will become luminous in proportion to its distance from the source of the rays and the quantity of the rays striking it, the container will be illuminated, the selenium cell under the influence of this light will change its ohmic resistance in proportion to the light, a current will flow proportionate to the change in ohmic resistance of the selenium cell, and the current flow will be measured and indicated on the dial of the galvanometer or other instrument employed for the purpose of making this electrical measurement, and the reading of this instrument will increase or diminish directly as the variation in intensity of the fluorescence upon the screen, which fluorescence is dependent upon the activity of the X-ray tube in emitting those rays which have the power of inducing such fluorescence upon the screen so constructed. It is evident, therefore, that such an instrument will give a direct reading without calculation and a continuous reading of the rays emitted.

It is necessary, however, that the current employed should be the same for each reading, and I have provided, therefore, a means whereby the voltage of the battery cell may be taken at any time in order to guard against error from this source.

I spent the greater part of three years in endeavoring to devise a meter which any one could read, which required

no calculation, not as much as it does to tell time by a clock. One, moreover, which would enable operators in different localities, using utterly different apparatus, to estimate the actual output of every outfit in X-ray, and thus to be able to compare results and methods. Such a meter I believe I have at last devised. It is far from perfect and, like everything else, is open to improvement, but it is the first thing that I have ever been aware of that actually indicated the output of a Crookes tube in X-rays. I believe the fundamental ideas underlying it are not only new and novel, but accurate, and I hope to be able to place in the hands of the scientific X-ray worker, within a short time, a carefully standardized meter, which will be recognized as standard and which will give at all times a true and accurate reading of the value of a tube as a transformer with relation to the quantity of electrical energy transformed into X-ray. This meter has nothing to do with the current flowing in the tube circuit. It concerns itself not at all with the make of tube coil or interrupter. It is not affected in its readings by anything or influence, except the quality and quantity of X-ray which strikes upon the fluorescent screen. It will necessarily be expensive, since the selenium cells themselves cost $30 each. But the apparatus must be manufactured with accuracy, as the first requirement, and cost of production should not be allowed to interfere with proper construction.

A RESUME OF THE RADIOMETRIC DOSAGE OF THE ROENTGEN THERAPY .

By Mihran K. Kassabin, M. D.

Director of the Roentgen Ray Laboratory of Philadelphia Hospital.

In presenting this paper for your thoughtful consideration. I beg to state at the outset that I can offer you nothing new on the subject, but I ask your attention to a resume of the various methods in vogue in this country and abroad.

The therapeutic value of the X-rays is so well established that we should no longer employ empiricism in dealing with disease; for having reached that stage in our knowledge where we have a uniform or standard unit upon which to base our judgment, the dosimetric method of the X-rays becomes a scientific entity.

I sent out a tabulated circular showing the various methods and requested members to fill the blanks so that I would be able to report in this paper the particular method by each leading skiagrapher, but so far I have received very few answers.

I will briefly classify and describe each of these methods, attempting to emphasize the possible advantages or disadvantages of each.

I. The measurement of the electric current.

II. The penetration method.

III. The physico-chemical method.

IV. The ionization method.

V. The photometric method.

I. The Measurement of the Electric Currents.

(1.) *The Current Going to the Primary Coil.* The voltage and amperage of a current that goes to a coil depends upon the varieties of the interrupters and the construction of the primary coil. The secondary or induced current depends upon the variety of the current or winding of the coil, because the same coil and interrupter may give different qualities of X-rays depending on the make and vacuum of the tube. Salomonson's experiments show that electric energy is absorbed in the rheostat and interrupters. Wehnelt considers that 30 to 80 per cent. of the energy derived from a battery is absorbed by the electrolytic break. Salomonson's wattmeter showed that 61.2 and 65.4 per cent. of current was lost. The Wehnelt interrupter in ordinary use absorbs from 53 to 60 per cent. of the whole energy supplied by the battery, therefore the relations of the amount of the current supply to the primary coil does not produce uniform induced secondary current.

(2.) *Milliamperage of the Secondary Induced Current.*

The milliamperemeter was first advocated by D'Arsonval, who used it with a Villard tube, and proved that the production of X-rays is proportionate to the intensity of the current, and has shown photographs in support of this assertion. The milliamperemeter measures the current passing through a tube, but it does not tell us how much is expended in the production of the X-rays.

Wertheim Salomonson says that X-ray production is a function of watts expended in the tube rather than of the current traversing it. If his theory is correct, and I believe that it is, then we should know the amount of energy or watts expended in heating the anode.

The milliamperemeter measures the resistance of the tube. There are degrees of vacuum where no X-rays are producéd, yet the milliamperemeter indicates a passing current. The resistance of a tube often depends upon the shape and angle of the anode (platinum), upon the surface of the cathode and the focal distance of the cathode. A valve tube makes the current undirectional as is shown by the oscilograph, the latter also indicates that there is no constant movement in the needle, whilst the milliamperemeter shows the slight changes in the vacuum by the deflection of the needle. It should never be forgotten that the reading of the milliamperemeter is not necessarily an absolute index of the amount of X-ray production in the tube. Thus we read the milliamperage and we know that the current is passing from the secondary into the tube, but how much current going through the tube is expended in the production of the X-rays? So much depends on the make, shape, size, etc., of the tube and on the relation between the cathode and anode that the answer is difficult, if not impossible.

(3.) *Spintermeter.* The length of the spark gap (parallel) on the secondary coil or induced current was the earliest method employed. The length indicates the internal resistance of a tube to the passage of the current; the longer the spark-gap the higher will be the vacuum. But it is a fact that the variation in the supply of current in the primary coil or interrupter will change the length of the spark-gap, with the same tube in circuit. The pointed rods of the electrodes, the composition of the rods, the atmospheric conditions, such as moisture, etc., the construction of the coil, interrupter, etc., the source of current and also the amount of the current will alter the length of the spark gap. Two different tubes with the same current and some spark-gap may give different degrees of radiation because the size of the electrodes may be different and different

metal be used, etc. Béclére, of Paris, employs a graduated rod capable of sliding to and fro. On this scaled bar he observes the number of inches or cms. This is a convenient form of measurement and every coil is thus supplied and in most universal use. This method is often misleading, as I have seen tubes with three or four inches (7.5 or 10 cm.) of spark gap where the rays were far less penetrating and in some instances cathodic rays were produced.

The data given by the Spintermeter holds good only for the special apparatus that the operator employs and not necessarily for other forms of apparatus.

II. The Penetration Method.

By this means we measure the rays directly outside of the tube, and their penetrative property or quality.

(4.) *The Radiochromometer of Benoist.* M. L. Benoist (Journal de Physique, Nov., 1901), devised this instrument, which is based on the principle that different metals possess different degrees of transparency as regards their penetration by the X-rays. A silver disk in the center of this device is used as standard, having a thickness of 0.11 millimeter. Around this disk are placed layers of aluminum, beginning with one layer and up to 12 layers, just like a clock dial. These 12 sectors are designated by lead numbers, arranged like the dial on a clock so that one can recognize them by their position without seeing the lead number. This apparatus can either be used with the fluoroscope or on a photographic plate. One of the sectors will match the tint of the central disk. A lead diaphragm is provided for bringing one sector into view and the diaphragm is rotated until the tint of the sector will correspond to the tint of the center. M. Benoist improved upon this apparatus (Archives d'électricite Medicale, April, 1906). His device resemples a telescopic arrangement so as to enlarge the numbers and the tints on the screen; it is also furnished with a glass to protect the operator while testing the rays. By rotating the lead diaphragm one can examine each sector successively. Dr. Geo. Pfahler places a mirror at an angle of 90 degrees, exactly as has been noticed in the fluoroscope, in order to prevent the rays being projected directly upon the face or hand and thus minimizing the danger of burns. This apparatus gives only penetrative power, but we know that there is a great difference between the penetration and fluorescence and also between photographic (chemical) and physiologic (therapeutic) effects.

(5.) *Skiameters and Penetrameters.* Many different metals have been used to determine the penetration power

of the rays, but as with Benoist's device this apparatus does not indicate the intensity of the rays. Two different tubes which have the same penetrative power, may differ in their chemical and physiological effects.

(6.) *Crypto-radiometer of Wehnelt.* This apparatus is practically similar to the above mentioned skiameters. It consists of a fluoroscope with a sliding or telescopic arrangement and provided with a sheet of lead to protect the hand of the operator and a single "V" shaped piece of metal which gradually increases in thickness.

III. The Physico-Chemical Method.

I believe that physico-chemical measurement because of its accuracy and precision more nearly approaches the ideal than the other methods in vogue. This method has been ably illustrated by Holzknecht. He based his theories and constructed his apparatus upon the principle that certain salts suffer a change of color when exposed to the cathode rays as reported by Goldstein to the Academy of Science of Berlin. Other substances when heated and irradiated undergo a change of color, as chloride of lithium which becomes greenish yellow, and carbonate of potassium, which changes to a heliotrope. On exposure to the air or at high temperature the colors of these salts are seen to disappear. He also proved that the X-rays and Becquerel rays possess this property, and that they are all transformed into ultra-violet rays at the point of impact with the surface.

(7.) *Chromoradiometer of Holzknecht.* Guido Holzknecht, of Vienna, presented this device for the consideration of the profession in 1902 and reported it at the Second International Congress of Electrology and Radiology. Holzknecht's studies on this subject led him to fuse certain salts and to expose them to the action of the rays. His invention, which is colorless, consists of a small capsule containing the reagent covered with celluloid. This reagent, whose composition has heretofore been kept secret, has been analyzed by a French chemist, Mr. Lind (Archives of the Roentgen Ray, June, 1906, p. 6), and M. Bordier describes it as follows: Ninety-nine and seventy-seven one hundredths per cent. consists of potassium sulphate, the remainder being potassium sulphite or hyposulphite, or possibly potassium tri-tetra or penta-thionate. The mixed mass is impregnated and held together with copal varnish. This capsule, which is placed over the skin to be treated, has a dirty yellow color due to the copal varnish, and under the influence of the X-rays the color changes to a greenish tint, gradually becoming deeper as the quantity of the rays is increased. After or often during the

irradiation this capsule is brought near to a standardized scale which is graduated in Holzknecht units, from 1 H to 24 H. The color scale is graduated from a greenish yellow to a deep green, which serves as a standard of comparison, by which to judge the color of the capsule after irradiation. The unit is indicated by H. The scale extends from 3 H. to 24 H. The treatment is interrupted in order to compare the color of a reagent with that of the scale, and this is repeated until a tint is obtained which corresponds to the precise dose required. As more than one sitting may often be necessary in the interval between the two exposures this reagent must be kept in darkness. This graduated scale holding the numbered capsule is kept in a light-proof box. Although this method would seem very correct in theory, yet in practice we meet with many difficulties. The standard scale suffers changes in color or it may fade in the course of a year. Subsequent to the exposure the capsule gets darker and must be compared immediately. The comparison of the capsule with the scale is very difficult. Different individuals and different parts of the body exhibit different degrees of susceptibility, and the various diseases display individual peculiarities to the action of the rays.

(8.) *The Radiometer of Sabouraud and Noire.*—In 1904 Drs. Sabouraud and Noire introduced a method largely employed in France. It consists of a small disk of paper over which is spread a layer of platino-barium cyanide; this salt turns brown under the action of the X-rays. M. Villard pointed out that under the influence of increasing doses of the rays, platino-cyanide passed from a bright green to brown, and at the same time the fluorescence gradually decreased. Upon a two-page leaflet the standard color pastille marked "A" (which is an unchanged green color) and another one marked "B" (which is brown and indicates the maximum of the dose which the skin can tolerate without producing dermatitis and will cause only epilation). The comparison should be done in a dimly lighted room, because if the pastilles are exposed too long to the light they regain their original green color. The pastille should be placed in a pastille carrier (8 cm. from the anode) and midway between the part under treatment and the anode. The standard color pastille "B" corresponds to a dose of 10 X or 5 H in Holzknecht units. Sabouraud himself admitted that the test is less sensitive than by the Holzknecht method, and that the color may change by the action of heat, light, moisture, etc. The pastilles are placed midway between the patient and the anode,

which is equivelent to 8 cm. distance from the anode. The location where the pastille is placed under the active hemisphere may not be equally irradiated, because the rays are unequally distributed over the active hemisphere.

(9.) *The Chromoradiometer of Bordier.* Bordier (Archives of the Roentgen Ray, June, 1906, p. 9) describes a new method, based on the principle that when platino-cyanide of barium is exposed to the rays it undergoes a change of color due to the dehydrating action of the X-rays, also that the same discoloration occurs when this chemical is placed in an atmosphere artificially dried by sulphuric acid or when exposed to a gradually increasing temperature. Under the action of light, rehydration may also occur. He describes his apparatus and reagent as follows: "The Bordier chromoradiometer differs from its predecessors. The barium-platino-cyanide, suspended in a thin layer of collodion, is placed on the skin itself, or at all events in the same plane as the part to be irradiated. The pastilles are square, with a diameter of 6.5 millimeters. The back of the square is adhesive to facilitate its attachment to the skin. A scale of colors is supplied, with tints Nos. 1, 2, 3, 4, corresponding to the principal reactions required in radiotherapy. Tint No. 1, a pale yellowish-green, is the shade that the pastille takes when exposed to the maximum dose of rays compatible with the complete integrity of the normal skin. With this dose of X-rays the hair falls out some twenty days after exposure, and grows again entirely in another twenty days. This is the weak normal exposure of Kienbock corresponding to a skin reaction of the first degree, accompanied by temporary loss of hair.

"Tint No. 2, of a sulphur-yellow shade, is that the pastille assumes when the skin has been exposed to an irradiation calculated to produce a strong reaction, viz.: erythema, tumefaction, and, at the end of the reaction, marked desquamation. This No. 2 tint corresponds to a mild form of Kienbock's reaction of the second degree.

"Tint No. 3 is almost of the color of gamboge. It corresponds to a reaction of the skin of the second degree. It is a true dermatitis. Latent period is eight to ten days. This is Kienbock's strong normal reaction.

"Tint No. 4 is of a chestnut color and corresponds to a reaction of the third degree which is accompanied by necrosis and ulceration of the skin. This is the strongest dose ever required and should never be applied to the normal skin. He obtained tint No. 4 after irradiation of a specimen of radium of a radio-activity of 100,000 for a

week at a distance of a millimeter from two pastilles." The soft tubes are not desirable for these reagents, as they emanate ultra violet rays, which will be confused with those of the X-rays. He reports cases that were cured at a single seance. He believes in one massive dose rather than in fractional doses, so common in this country. This method is also subject to the same objections that I have mentioned before.

(10). *Quantimeter of Kienbock.* Dr. R. Kienbock in 1905 introduced this new method of direct dosimetry at the Roentgen Congress in Berlin, and asserted that in 1900 he demonstrated that the changes noted on a photographic plate are an accurate measure of the therapeutic dose. Admitting (Archives of the Roentgen Ray, June, 1906, p. 17), however, that Stern (Journal of Cutaneous Diseases, December, 1903) published a paper on the photo-radiometry, and suggested the use of photographic films, to be compared with a "normal scale;" but at that time Kienbock was unaware of the fact.

He describes his instrument as follows (Archives of the Roentgen Ray, June, 1906. p. 17): "My quantimeter consists essentially of two parts, a strip of photographic paper, which is easily applied to the irradiated skin, and a normal scale of graduated tints, with which it is to be compared. The paper is covered with a sensitized film of chloro-bromide of silver in gelatine. After exposure, the strip may be developed in a dark room or by means of a small light-proof box. The development can be carried on in daylight in the consulting room. The film is then compared with the standard scale, either at once or after drying. The developing solution is of constant composition, and should be used at a temperature of 18 degrees C. or 64 degrees F. for a period of exactly one minute. After fixation, the strip of paper may be immediately compared with the scale. The unit of Roentgen light which we call X is equivalent to one-half of a Holzknecht unit, and to one-tenth of the Sabouraud-Noire maximum dose. The formula is as follows. 1 S-N maximal dose equals 5 H or 10 X.

"This reagent enables us to measure the penetration or the degree of hardness of the Roentgen light. In comparison with other dosimetric methods, the quantimetric method has the advantage of greater exactness and the possibility of estimating small differences of dosage. This method is a permanent registered record. The disadvantage of this method is the difficulty which is encountered in comparing and distinguishing the slight differences of

tint on the scale. Careful development is necessary and always tedious. When massive doses are given, the color will be darker and will be more difficult for making comparison with the scale. The degree of the sensitiveness of the emulsion of the paper may frequently differ."

(11.) *The New Radiometer of Freund.* This apparatus was used in 1904, and is based on the color changes occurring in a 2 per cent. solution of pure iodoform in chloroform. This solution normally retains its color unchanged for 48 hours and is so very sensitive that a difference of tint may be observed between two portions of the solution. one of which is exposed to the rays for three minutes, while the other portion is screened from the action. Slight heat and light will alter the color of the solution, and although this method is most accurate and sensitive, the solution is too unstable for practical and clinical purposes.

The iodoform (C H I3) is decomposed by the X-rays with the liberation of free iodine, imparting a claret color to the solution. Freund's solution shows a change of tint in six minutes equal to that attained in ten minutes by the use of Holzknecht's pastilles.

(12) *Precipitation Test.* Schwartz of Vienna (Wiener Klin. Wochft., May 31, 1906) demonstrated a method of measuring the strength of the Roentgen rays which is based on the precipitation of calomel, in a mixture of ammonium oxalate and corrosive sublimate. This mixture is a clear fluid which, sheltered from the light, keeps indefinitely. Exposure to daylight or to the Roentgen rays causes precipitation of calomel. The amount precipitated is determined by centrifuging in a graduated capillary tube. Three millimeters of the precipitate in the capillary tube corresponds to about the strength of a Holzknecht unit. This technic, with the usual methods of testing the strength of the latter, has the disadvantage of being a subjective test of color.

IV. The Ionization Method.

Prof. Roentgen in his second announcement stated that he had alredy made this discovery, and probably prior to this J. J. Thomson found that the X-rays would discharge both negatively and positively electrified bodies, by experiments on Hankel's electroscope or electrometer. Thomson stated that the discharge varied somewhat with the intensity of the rays by the relative luminosity of the fluorescent screen and by the relative darkness produced upon the photographic plate in several instances. This method is based on the principle that X-rays have the

power to ionize the gases through which they travel.

(13.) *The Ionization of Confined Gases.* Milton Franklin (New York Medical Journal, April 22, 1905) states that "so far as I have been able to ascertain, this method has not been systematically used to measure the intensity of the X-rays. This method has been commonly employed to measure the radio-activity of the radio-active substances. Air is rendered a conductor of electricity by the ionizing agent, and the measurement of the amount of current flowing through it under given conditions gives an absolute index of the activity of the radiation. It is necessary only to charge the electroscope by applying a rod of vulcanite, sealing wax, resin or other suitable material, which has been previously electrified by friction, and then to time the transit of the filament under the influence of X-rays. The rate of discharge will vary directly as to the activity of the radiation." The apparatus of the instrument is as follows:

"The electroscope is charged by having brought into contact with the knob a rod of vulcanite which has been electrified by friction. The knob is brought into communication with the filament, while the vulcanite is in contact, and released as soon as the filament has assumed a horizontal position. The electroscope is brought to the same distance from the tube as the plate or patient (in any position) and while the tube is running, the shutter is opened and the time in seconds, occupied by the filament in transit, is noted. The number of seconds is the exact co-efficient of energy of the rays, and when compared with any other reading made under any circumstances whatever, with a similar instrument, the ratio of energy of the two radiations will equal that of the two times.

"In this method with an electroscope, on the other hand, of the gold leaf pattern, the relative activities of two radiations may be compared with great accuracy and expedition, and if one of them is the standard unit of activity or bears a known ratio to the standard, the value of the other, in terms of the standard, will be readily deducible. Atmospheric variations must be taken into consideration. The number of seconds which it requires for the filament to traverse the field is the co-efficient of the strength of the rays. All calculations and variations due to atmospheric absorption must be eliminated at once."

(14.) *The Radio-Active Standard of Phillips.* Phillips (Archives of the Roentgen Ray, June, 1906, p. 27) utilizes the principle of Franklin's method of ionization and suggests radium as the standard unit. He describes

the modus operandi as follows: The method consists in attaching two similar discharge vessels, one to each of the plates of the electroscope, a thin strip of silvered mica, and forms a right angle to the horizontal rods, the former is electrified inductively. The horizontal rods are connected with the standard radium; when the rods are equally charged the needle is steady, but gives no deflection.

Phillips further says: "We may also conveniently compare the activities of various substances by noting the time taken for a gold leaf electroscope to discharge between certain potentials. To do this with anything approaching accuracy, however, the motion of the leaf must be observed with a reading telescope." He calls the absolute unit, Becquerel or one Curie, while the commercial unit might be appropriately known as one "ray."[7]

V. The Photometric Methods.

This method consists in comparing the fluorescence of platino-barium-cyanide screens with an artificial light, either with a fluorescence produced by radium or a radioactive salt.

(15.) *The Radiometer of Courtade.* This instrument consists of a lead shield containing two similar openings, covered by a fluorescent screen. The radium, which serves as a standard of fluorescence, is placed behind one aperture. The degree of fluorescence on the second screen produced by the X-rays is equalized with that of the standard by altering the distance of the Crookes tube. This distance will be a measure of the amount and the quality of the radiation. This method is not thoroughly or absolutely correct, because the intensity of the fluorescence of all the platino-barium cyanides is subject to great variations when exposed for a long time to the action of radium or the X-rays.

(16.) *The Guilleminot-Courtade Method.* Founded on the same principle as the radiometer of Courtade, Guilleminot employs a sample of radium as his standard of comparison whose activity is 50,000. He considers "the unit of quantity of the X-rays is that quantity falling on one square centimeter of the surface in one minute of time." This unit he calls the unit "M." For example, if the Crookes tube has to be placed at a distance of three meters, in order to produce an equal illumination of the screen, then the intensity of irradiation of the field at three meters from the tube is said to be unity. From this it is easy to calculate the number of units "M" absorbed per minute at a distance of 10, 15 or 20 centimeters. Thus

in the above example the number of units absorbed per minute at 10 centimeter distance is 900, "M" = 3 meters, i. e., 300 cms. then 300 cm. ÷ 10 cm. = 30 cm., therefore 30 cm. × 30 cm. = 900 cm., while it is 400 at 15 cms., etc., 11 (Archives of the Roentgen Ray, June, 1906). This is open to the many objections mentioned before, the platino-barium-cyanide changing its color of fluorescence, etc. This does not give us the amount of absorption in the tissue, but we infer that from calculations deduced."

(17.) *The Fluorometer of F. Williams.* This instrument (The Roentgen Rays in Medicine and Surgery, 1903, p. 640) depends upon the distance that a tungstate of calcium screen must be held from a given vacuum tube, in order that the illumination from it may equal that from a radio-active substance which has been measured by a standard source of light. "I found," says Williams, "that when a tungstate of calcium screen with the radium lying upon it was placed over a vacuum tube in a dark room and the X-rays allowed to strike it the radium was less bright than the luminous screen; but that as the screen was moved further away from the vacuum tube the brightness of the screen diminished until a point was reached at which the screen was less bright than the radium, and that then by gradually approaching the screen nearer the vacuum tube, a point was found at which the radium and the screen were about equally bright.

"I experimented with several tubes in this way and found that the distance at which the screen and the radium were about equally bright was different with both tubes, the limit of variation being between 10 and 41 centimeters; and the distance was constant for the same tube under the same conditions. As by means of a photometer the amount of light given off by the radium can be measured in terms of a known standard, so the amount of fluorescence produced on a tungstate of calcium screen by a given tube the brightness of which a given screen is capable, may both eventually be referred to the same standard. The fluorometer may serve as a basis, with a given apparatus, for determining the length of exposure when X-rays are used as a therapeutic agent, and likewise when they are employed for taking radiographs. This instrument has the objection that the durability of tungstate of calcium varies with different tubes and also the vacuum of the tube changes during exposure and requires constant attention."

(18) *The Method of Contermoulin.* With this method, instead of employing radium, the standard fluor-

escent screen is illuminated by an acetylene light. This is open to the same objection as stated above.

(19.) *Selenium Photometer of Ruhmer Levy.* Ruhmer Levy presented at the Berlin Congress in 1905 a new instrument for measuring the X-rays. A selenium cell is clamped in position at a fixed distance from the anode, a current from a couple of dry cells is passed through the selenium and its intensity is read off on milliamaperemeter. The X-rays alter the resistance of the selenium, and the variation of the current is therefore a measure of the quantity of the rays.

(20.) *Fluorescence of the Tube and the Appearance of the Electrodes.* This method does not afford a reliable means of determining the penetrability of the rays, as the fluorescence depends upon the kind of glass composing the tube. In a dark room this fluorescence will be more discernible. Behind the anode there may often be noticed annular patches of fluorescence, indicative of a high vacuum. In studying the appearance of the electrodes, a phenomenon sometimes noticed is the emission of a fine smoky stream around the edge of the cathode, indicating a high degree of vacuum. A low vacuum in the tube can be recognized by a conical stream of cathode rays of a blue color. The appearance of a cherry red heat at the anode indicates that the tube is working properly, and that rays of a high degree of penetrability are being produced. However, this will vary according to the thickness of the platinum anode and the strength of the current. It should not be forgotten that the same tube will fluoresce differently with the different amount of current, which will produce more or less penetrating rays.

(21.) *Thermometer of Kohler.* Kohler places a thermometer into a depression in the Crookes tube, whereby he gauges the variations of temperature as indicative of the quality and quantity of the rays.

At present we have no reliable, accurate or practical standard or unit of dosage; every one of these methods is open to objections and to certain errors. The possibility of having a standard unit becomes a difficult problem, because of the idiosyncrasy of the patient, and because no one can make any positive statement as to how

many treatments any one case demands, the personal equation enters so largely into the consideration. We cannot deduce the amount of physiological and biological action of the rays on the tissues by measurement of the chemical and physical properties of the rays. The question arises: "What standard unit shall we adopt, so that the unit is accurate, practical and precise?" It is my sincere wish, and I believe it is the desire of all the members, that a committee should be appointed to formulate and ratify the selection of a national standard unit.

May I ask for the hearty co-operation of every one interested in this, the most fascinating branch of medical science.

Discussion on papers by Drs. Piffard, Kassabian, Johnston and Phillips.

Dr. George E. Pfahler, Philadelphia: It seems to me that there cannot be much point to this discussion because we know nothing about the subject of measuring the X-rays. In Benoist's scale we have a means of measuring the quality of the ray and with the ammeter we can measure the quantity of electricity that goes through the tube, but that does not measure the rays. What we want is some instrument that will measure the unit of quantity of the ray. Perhaps Dr. Johnston's instrument will solve the problem.

There are four definite factors that we can consider, and even though they do not give us a unit of measurement, yet they enable us, at least, to duplicate our results. These factors are a certain quantity of electricity, as measured by the milliammeter; a certain quality of the ray, as measured by Benoist's scale; a certain time of exposure, as measured by the clock, and a certain distance of tors constant, as I do in my work, we can produce fairly constant results; that is, we can duplicate them. By varying any one of these factors, you vary the results of your work. These factors should be mentioned when we report cases so as to make the results more correct.

Dr. Kennon Dunham, Cincinnati, Ohio: As Dr. Piffard's paper dealt with nothing except ionization and that is not new, we can dismiss that paper from the discussion. As to Dr. Kassabian's paper, nothing new was meant to be brought forward. The doctor presented that paper at the request of the executive committee for the sole purpose of putting the society in the position to discuss the subject intelligently. We owe Dr. Kassabian a vote of thanks for giving us this excellent resume of various methods thus far employed.

As to Dr. Phillips' paper, we all know that we need a standard unit of measurement. Whether ionization is the best method of solving this problem or not is another question which is open to a great deal of discussion. I doubt very much whether we wish to measure one substance by the standard of something else. Ionization can be produced without an X-ray tube or without a tube of radium. While a unit in anything is very valuable and desirable, we certainly ought to arrive at something more definite than simply ionization. I believe that Dr. Johnston has the keynote to that.

These papers bring up two suggestions. I think that the work done originally by Dr. Roentgen ought to be republished for the benefit of all the members of this society in our next volume of

transactions. I really believe that if more of us were to read Roentgen's original articles carefully, it would keep us from making a great many mistakes or a rehash of work already done well. I also believe that this society should not only request its members individually to write to this committee in London, but that the society should have a committee of its own to work in conjunction with it.

As to Dr. Johnston's paper, I wish to discuss this selenium cell because I have been working on this same thing for quite a while independently of Dr. Johnston. A little more than a year ago mention was made at a Berlin congress of the selenium cell. I happened to have one of the cells and I determined to experiment with it. I turned the X-ray on it direct, putting all sorts of different amounts of voltage through the coil. I put a fluoroscope up in front of it, but nothing seemed to work out right. I put the selenium cell away.

I heard no more about the matter until Dr. Johnston sent in a little abstract of his paper in which he stated that he had a direct reading X-ray meter, a fluorescent box, a selenium cell that will give a reading on the amperemeter. So I went to work again. The cell I have is smaller than Dr. Johnston's. I put it inside of a wooden pill box and poured my tungsgate of calcium salt around the cell, and then put it up in front of the tube and to my joy it did just what Dr. Johnston said it would. But my experiments differ from Dr. Johnston's in that I got no reading on the milliamptmeter. I did, however, get a good reading on the millivoltmeter. Doubtless Dr. Johnston has a better cell than I have. I have a letter from Mr. Peavy, the superintendent of the Bell Telephone Company in Cincinnati, who made all my readings and loaned me his standard meters. He vouches for the correct readings, that is, as nearly correct as the standard voltmeter can be read by the naked or unassisted eye. The angles were taken carefully and every protection was thrown around the experiments which the crude apparatus would permit. The Weston milliamptmeter showed such small reading, if any, that it could not be recorded.

The fact that I wish to bring out is that this instrument does measure. This is the way of reading. The selenium cell is brought very close to the tube, and as many rays are cut out from the surface of the tube as possible. This is accomplished by surrounding the cell with an opaque shield with a window in it. When the light from different portions of the tube falls on the selenium cell different registrations are given by the millivoltmeter. Divide your tube into two hemispheres along the line of your anode, and measure the rays sent off at different angles from the cathode stream in this plane. Perpendicular to the cathode stream two and a half millivolts were registered at forty-five degrees it measured from two and a half to three millivolts; on either side of the stream at as acute an angle as you could measure it read one and a half millivolts; while from the hemisphere behind the line perpendicular to the line of greatest register, minus readings were obtained. In other words instead of reading any amount of X-rays we read a minus quantity. The reason for that, I thought, was the fact that the static charge around the outside of the tube seemed to increase the ohms of resistance inside the selenium cell, or, in other words, it made it harder for the current to go through. Whether the line that is perpendicular to the anticathode is the exact line or not is open to question, as it was not precisely the same with all tubes.

I wish to call your attention to a little device of mine. I take a bottle containing a two per cent. iodoform and chloroform solution and place that in a paper covered with light-tight paper. That I lay on the patient to be treated. Then I take a box with a selenium cell in one end and focus a strong light exactly on the cell and read its registration on the millivoltmeter. After you have exposed the iodoform and chloroform solution or some form of silver salt, or anything that the X-ray will darken during your treatment, you interpose it between the light and the cell and again read the registration. Of course the difference in these millivolts is the amount of work done by the X-ray in darkening the solution, and as the amount of silver or iodine which is precipitated can be absolutely determined by chemistry, so much for a given time, this gives us a standard that will assist in making a meter that will read as easily as any volt or ampmeter.

It is needless for either Dr. Johnston or myself to say to you that this is crude. Necessarily it is crude, but if we can get these readings in this way, we can certainly with a more perfected instrument settle the dispute about the amount of X ray used.

In electricity we have the voltmeter to measure the difference of potential; we have the ampmeter to measure intensity; also the watt-meter to measure quantity in a given time. So with the X-rays —Benoist's radiochrometer might compare to the voltmeter; Dr. Johnston's meter to the ampmeter; while the instrument which I recommend takes the place of the wattmeter.

Mr. H. Clyde Snook, Philadelphia: The question of a standard unit is a burning one with us, as it is in London. The work they are doing in England should meet with our hearty approval and approbation, and we should assist their committee as much as we can. The question of a standard of radioactivity is one which at the present time concerns two classes of investigators. One is the student of radioactivity, the man who is investigating substances that give off atomic particles, substances that possess the property of radioactivity, substances which emit radiations without being affected by any conditions which man is able to control. The second class of men interested in this problem are the X-ray workers. The question of a common standard for both these classes of men is now before us awaiting an answer. The reasons why a great deal of work must yet be done before a common standard can be found are many.

Ionization is the name for an idea which I understand is the production of conductivity in a gas, by a substance, and by the reaction taking place in some form of a vacuum tube. Ionization being merely the property of a gas complicates matters exceedingly. Radium gives off many kinds of rays, among them the X-rays. X-rays, up to the present time, have not been studied with respect to the degree of ionization which different degrees of penetration produce on a gas, or on various gases, or on air, which is commonly used. A soft tube with the same consumption of energy ionizes air to a much greater degree than a hard tube, and if we adopt standards of ionization to measure energy emitted from an X-ray tube, we must take into account the degree of penetrativeness of the radiation emitted from that tube.

We do not have correct information on this point and a curve must be plotted from the results of the investigations of many

workers. The X-rays are absorbed by all the substances we are using, and a great deal of work must yet be done before even by this method we can arrive at some practical solution of the problem.

I agree with Dr. Pfahler that we should record our work in the manner he has indicated. I think that the work begun by Benoist is the sort of work which shall be the foundation for the solution of the problem. At the present time the radio-active men, led by Phillips and others, are casting about for some substance constantly radioactive which can be used in the production of a practical standard, but they have not yet found such a substance.

Dr. Kassabian's idea of the collaboration of the results of a great many workers is the one means at the present time, I think, by which we can hope to help ourselves. I cannot agree with the suggestions to the advisability of appointing a committee to take up this subject at the present time, not until we can have more results collaborated. It seems to me that it is a little too early to attempt that.

There is due Dr. Johnston a great deal of credit for having done an ingenious thing. Dr. Dunham also deserves credit for having taken up the work at the cue of Dr. Johntson. Dr. Dunham gives credit to Dr. Johnston. They have both done very clever things. As to the millivoltmeter and the milliamperemeter, I should like to say to Dr. Dunham that under the conditions that he was using his millivoltmeter he was really using it as a milliamperemeter with a fractional scale. It was a small milliammeter.

The method of measurement of the absorption of the energy which Dr. Dunham describes is very pretty, indeed, and it is so absorbing in interest that it is well to recall at this time some of the experiments done originally by our English friends. I have forgotten who it was that did the original experiments, but several years ago a tentative measurement of the quantity of radiation which was given to a patient or to a plate was measured by the depth to which the radiation penetrated in a pile of superimposed photographic developing out papers, such as Velox, as was shown by the subsequent development of the papers. A pile of thirty or had been irradiated than by a salt which had not yet been exposed, the result being due to a chemical reaction similar to that brought about by light.

Dr. William H. Diffenbach, New York City: I should like to take exception to the adverse criticism of Holzknecht's method. He told me last summer that his apparatus is in use in over 300 laboratories and is giving good results. It is the best apparatus we have at present for measuring the absorption of the ray. The Benoist scale gives us the penetration, but what we want to know as therapists is how much of this force is absorbed into the tissues. The chromoradiometer of Holzknecht fills the bill quite well at the present time. You are always on the safe side if you will follow the doctor's advice and keep within the limits of his color scale.

He has lately improved the composition of the pastilles, and he is not at all adverse to giving their composition. They are composed of potassium sulphate and carbonate fused together and covered with a damar lac which permits the free passage of the rays. The coloring scale that Dr. Kassabian described is arranged from Holzknecht's experience. If in giving five Holzknecht's units for the treatment of epithelioma or a certain skin disease the operator is careful in watching the color scale it is almost impossible to

produce a severe X-ray burn. I mention this in order to place this matter before the society in its correct light.

Dr. Johnston said, in speaking of the Holzknecht method, that once used these pastilles must be laid aside because they are of no further use. These pastilles can be used again after having been submitted to sunlight for various lengths of time.

Dr. Reginald Morton, London, England: I am very glad to have this opportunity given me to speak on Dr. Phillips' paper. I think that the feeling in London with regard to the Saboraud pastilles and the various other things mentioned is that up to the present time they are the best means we have at our command for measuring the dosage of the X-ray. What we want to know is, what is the strength of the radiation being given. It is all very well to be told afterward what you have done. Sometimes you will find that there are developed things in these cases which we cannot explain, but they are definite chemical changes.

My colleague, Dr. Sequira, has given up the use of the pastilles and is using an apparatus that he has devised. He works with the standard current through the tube and has an interruption counter. The one method that we have followed in London that is making a step in the right direction was originally suggested by Dr. Milton Franklyn. I induced a firm in London to make this instrument, and I understand that since then Dr. Dean Butcher has made some alterations in it. We realize that at present there is nothing that approaches an ideal. We are working simply with an ammeter, with a constant distance, as nearly as possible, and we keep our tubes at a constant resistance, as nearly as possible, working also with a constant spark gap, and for everyday work we cannot find anything that is much better; but we must have our tubes practically new. With the old tubes that have been softened and hardened repeatedly, while you can get them down, yet the quality of the rays is not the same. But such a tube does not produce a dermatitis nearly so readily as another tube. It is a safer tube to use, but when dealing with epitheliomas it is not a satisfactory tube.

Dr. Ennion G. Williams, Richmond, Va.: In regard to the measurement of the dosage by means of ionization in the static field surrounding the tube, I wish to direct attention to one objection. Ionization is to some extent dependent upon the static field, and the static field is not always in proportion to the light from the tube. As often happens there is considerable leakage around the tube, particularly if the terminals of the tube are not far apart. This will alter the static field and consequently the ionization.

It ought to be one of the efforts of our society to try to solve this difficult problem. That is why we come to these meetings, to have some of these perplexing problems solved, and I hope that the suggestion to appoint a committee for this purpose will be adopted.

Dr. Alfred L. Gray, Richmond, Va.: The experiments made by Drs. Johnston and Dunham will certainly be of a great deal of benefit to us, but it seems to me that they are assuming that the same rays which produce fluorescence also produce the physiologic effect. In fact, it seems that the trouble with these various devices is that we are taking for granted, all the time, that the physical, chemical and physiologic effects of the rays are identical. It has been my experience that certain tubes would produce a good nega-

tive, and yet they would not produce satisfactory therapeutic results. I have some tubes, and I recall one in particular, that I rely on both for finer negatives and also for finer therapeutic work. I cannot conceive of our arriving at a therapeutic unit correctly by a chemical or physical change when we do not know that the physiologic effect is a chemical change at all.

Dr. Eugene W. Caldwell, New York: I want to emphasize the fact that Dr. Johnston's device for measuring the ray while we are using it and not afterward when we have done the work is a very long step in advance. Of course, the scheme has some objections.

The measurement of the X-ray is made by measuring the change which the ray produces in the electrical resistance of the ingenious combination of selenium cell and tungstate screen. The amount of change or resistance will vary also with the fluorescing qualities of the tungstate which deteriorate with age. Error from this source might be obviated by occasional renewing of the tungstate screen. The resistance of the selenium changes also with changes in its temperature and the amount of moisture it contains. Errors from these causes might be kept within practical limit by using hermetically sealed cells such as are made by Ruhmer, and by using a temperature connection as is done in many other physical measurements.

Dr. Dunham has suggested the use of the millivolt meter instead of the milliamperemeter as described by Dr. Johnston. It should be remembered that the ultimate purpose of the meter in this work is to indicate a change of resistance in the selenium cell. With appropriate connections this should be done equally well either by measuring with a milliamperemeter, a change in current strength, or by measuring with a millivoltmeter, a change in potential difference which is in turn measured by the change in current strength which it produces in the meter.

A more direct measurement could be made with an ohm meter, which indicates directly, the resistance in ohms. The reading of such an instrument is not affected by changes in the E. M. F. of the batteries which must be taken into account when using the milliamperemeter or the millivoltmeter.

Dr. Sinclair Tousey, New York City: For several years past I have been using a method of measuring X-ray dosage which is based on this same property of luminosity in a fluorescent screen. I made a brief reference to it last year when this subject was first brought up. My method has been to take an ordinary box fluoroscope with a platino-barium-cyanide screen and to get away as far as I could from the X-ray tube and still be able to see the fluorescence. To make sure that it was not an optical illusion I carried a heavy bell and when I pressed the button the nurse turned the current on or off. When at a distance of thirty or forty feet I am very sure that I can see the screen light up, and can also see the difference when it is turned off, then I consider that distance an index of the intensity of the radiation. For my own convenience I have adopted units based on the number of yards or meters that I could go away and still be sure that I could see the screen shine up. So that 13 T indicates an intensity which would carry thirteen yards. But I have not depended on that as a sole measure of the application I was making.

I think that the intensity of the illumination, whether meas-

ured that way or by Dr. Johnston's or any other apparatus, is not an absolute measure of the total quantity of radiation. I think that flashes of the X-ray, if they come at the rate of a dozen a minute, will produce the same degree of illumination in a screen as do flashes coming at the rate of sixty times a second. So that all these factors must be taken into consideration when measuring the X-ray dosage. It would not be right to base a system of dosage on 13 T at a distance of ten inches for ten minutes with a static machine and apply the same to a coil run on a Caldwell interrupter with only a dozen interruptions a second. So that in my own case I note the number of interruptions, the number of milliamperes passing through the tube and the degree of penetration, the degree of resistance in the tube as indicated by the spark gap; a milliameter showing the current passing to the tube and spark gap showing resistance overcome by the current.

I have used this system and have been able to time my exposures so as to produce the right effect. I have been able to produce a bronzing and even swelling of the skin without any positive tendency to ulceration. The quality of the rays, and the intensity and the distance and the time and the frequency of exposure are the most valuable elements to consider, as was pointed out by Dr. Pfahler.

Dr. Rome V. Wagner, Chicago: I think Dr. Johnston has devised a perfect fluorometer. The one question that arises is whether the therapeutic action of the current can be governed by the action on the fluoroscope. The fluorescence of any material seems to be largely governed by the penetration of the ray or the current through a medium vacuum tube of high tension and you get greater fluorescence, more luminous fluorescence than with a much larger quantity of current passing through the same tube at a lower tension. If you have ever compared the fluorescent action of a tube excited by a static machine to the fluorescent action of a tube excited by a coil, you will readily recognize that the static machine shows greater fluorescence in proportion to the chemical action of the ray; that is to say, the static machine that will give a good fluoroscopic picture will not affect a sensitized film nearly as quickly as a tube will that is excited by a coil.

There is a great difference in physiologic action, and it will not be safe to adopt the dosage of the X-ray for therapeutic requirements as governed by the action on the fluoroscope.

Dr. A. Clifford Mercur, Syracuse, N. Y.: The point which Dr. Wagner made suggests a question I want to ask Dr. Johnston, and that is, whether fluorescence increases proportionately to the photographic activity of the X-rays. I am led to ask this question because I feel quite certain that with an old Tesla coil and a double anode tube, I have seen quite as brilliant a fluorescence as I have seen today with a recent Rhumkorf coil, and a recent tube; and I think that the exposures of the two machines compared would be, perhaps, like 30 to 1, that is the Tesla outfit would require in radiography about thirty times the exposure that would be required with the tube energized by the Rhumkorf coil. I asked the maker of the Rhumkorf coil, what that meant, and he said that fluorescence only increases up to a certain point and then ceases to increase while the effect in the negative film goes on increasing. It is possible that the sensitiveness of the retina of the eye differs from that of the selenium tube, and that the latter recognizes things that the retina cannot recognize. Yet there is a possible

fallacy in attempting to measure light from the fluorescent screen beyond a certain point, and I would ask whether the observation might not be made sufficiently far away from the X-ray tube as to overcome this difficulty. As the effects produced by X-Ray decrease with the square of the distance, there might be found a point where the fluorescence increases gradually within its limit and still sufficiently to serve as a mean of measurement radiographically.

But further from Dr. Dunham's diagram it would seem necessary to place the screen between the tube and the subject, and any instrument placed between the subject and the tube would interfere with the action of the rays on the subject, so that there would seem to be a practical difficulty in using the instrument at the same time one is making the exposure. These are the points I wish to bring up, asking for an explanation from Dr. Johnston.

Dr. Lewis Gregory Cole, New York City: This morning Dr. Pfahler showed us the results of his experiments with silver, leather and aluminum, and in one of the plates he showed us the photographic action on the plate with silver and also with the leather interposed. In one of these cases there was a marked physiologic action, while in the other case there was practically no physiologic action apparent on the skin. Bearing that in mind, it seems to me that Dr. Johnston's method of estimating the rays is very practical from the skiagrapher's standpoint, but not from a therapeutic standpoint. If you are going to cut off that amount of radiance that Dr. Pfahler showed us might be cut off by putting up a leather or silver screen and still obtain the same therapeutic action, what would the action on the selenium cell be, and would it register the therapeutic or the radiographic activity of the tube?

Dr. George E. Pfahler, Philadelphia: The fact that we have discarded old methods of measurement is sufficient testimony of their value. We cannot depend on any standard that must be measured by the eye, because the eye is not a constant factor. I do not think that Dr. Johnston's apparatus is meant to fill every want we have. We will probably have some other problems to work out next year, but Dr. Johnston certainly has made a most decided step in advance, a step that this society will point to with pride.

We have a standard of measurement now by means of which we can measure, at least, some of the rays. Of course, we cannot measure those that affect the skin or the deep tissues, but we can measure something, and it is a constant factor. It is a convenient and practical apparatus, and for myself I wish to thank Dr. Johnston for what he has given us today.

Dr. Mihran K. Kassabian, Philadelphia: I would like to ask Dr. Johnston how his meter differs from Celamie's method.

Dr. Johnston, closing the discussion: I never heard of that method before, but, then, Dr. Kassabian's knowledge of methods of measurement is greater than mine. It may be that my method is old. I do not know. This method is simply the result of a lot of hard work to get something to look at and give me some idea of what the tube is doing without using the fluorosocope and burning my hands. I want to live and continue to use the X-ray.

I do not care what it reads or what calibrations you put on the scale, you can always tell what the meter is doing by the way the pointer is going over the dial. Of course, it will never tell me what the patient is doing or whether he has an idiosyncrasy to the ray. I never invented anything that is a substitute for brains. What the meter indicates is only the fluorescence of the

screen. That is all, unless the X-ray has some effect on the selenium cell in addition to the effect produced by fluorescence. I know that this is true, but cannot prove it.

Every man in this society to whom I have spoken of this meter has given me the best he knew, and I have been very much gratified to have everybody offer suggestions that were of value to me in my work. Dr. Strong's invention is no doubt a good one. The reason I used tungstate of calcium is that I had a screen in my office nine years old that was still doing good work.

The lantern slides I showed you are purely diagramatic and are not intended to show the apparatus as it is. It takes forty volts to overcome the resistance of the selenium cell I showed you.

At present we have only a tantalizing view of the matter, but there is no reason why we should not be able to work this thing out and make a practical meter of it.

Dr. Charles Lester Leonard, Philadelphia: On behalf of Mr. Phillips I wish to thank the society for the interest aroused in this subject. What we need is co-operation, and to further this co-operation we ought to have a committee that will get to work on this matter and give us something which will approximate a measure for therapeutic roentgenographic effect, a measure of what we are using. Whether that measure is to be one for radium only or for all radioactive substances, including the X-ray, will be decided by what is produced; what each one of us can think of and use and test and try. We are only beginning with this work. A committee should be appointed with the commission to canvass the society as fully as possible and report results at the next meeting, submitting its conclusions or suggestions for co-operation with the society in London.

I wish to congratulate Dr. Johnston and Dr. Dunham on the valuable work they have done. I was present in Berlin and heard the selenium cell referred to, but the literature, which is contained only in German journals, is not complete, nor has the matter been worked out as thoroughly as it has been by this society. Our members deserve great credit for the work accomplished and we should honor them by placing them on a committee to investigate this matter further, and report to us at our next meeting.

ADVANTAGES OF THE USE OF X-RAY FILTERS IN RADIO-THERAPEUTICS.

By Dr. Reginald Morton, London, England.

The experiments that we carried out in the London Hospital for the past year were the outcome of an idea of mine. I suggested to one of my assistants that we might get better results in the treatment of carcinoma if we did not have to stop our treatments so often on account of the intense dermatitis. I might say that in my department the treatment of inoperable carcinoma comprises the bulk of the work. It has been necessary to divide the department and now all superficial skin lesions are treated in the skin department. When I made that suggestion one of my assistants jokingly remarked that we might try to use asbestos to keep the fire out. We had a piece of asbestos and made use of it, and to our surprise we found that we could give double and treble the number of applications without causing any dermatitis that we could without the asbestos.

I then suggested that we try linen saturated with tungstate of soda, which being a metal of high atomic weight would probably serve the same purpose, and that, I might say, is what we use most of all. Tungstate of soda is exceedingly cheap and we saturate the linen with a saturated solution of the soda, keeping a piece or more over the part to be exposed to the X-ray. We have found that material to be quite satisfactory in the results produced. We can give three or four times the number of applications that we could before, and since we have begun to use this method we have never had anything more than a slight erythema. The exposures we give are, as a rule, of not less than thirty minutes' duration and sometimes of an hour's duration in a case of large carcinoma of the breast. I am certain that we could not do that ordinarily without burning the skin most severely.

Shortly after I began to use the tungstate of soda, I received a copy of the transactions of last year's meeting of this society in which I saw Dr. Pfahler's suggestion to use wet sole leather. I promptly got a piece and found that it worked as well as anything I had tried. In the case of a private patient who always got a severe dermatitis after ten applications, I gave sixty applications with the use of the sole leather, and while the relief of the symptoms was as good as ever. she had no dermatitis; a clear case showing the value of the leather filter.

I am quite sure that these filters cut off only those rays which are absorbed by the superficial tissues which, after all, when treating deep seated growths like a carcinoma of the breast, are of no use. We want to stop these rays before they come to the skin.

I experimented and tried to make other kinds of screens, and found that one which makes a very nice screen, but which is a little more troublesome to make, is to saturate lint in a solution of barium chloride, as strong as possible, then dip only just enough acid to convert the chloride into barium sulphate, which is very insoluble. The barium is precipitated into the meshes of the cloth and readily makes a very good screen, although, as I said, it is more troublesome to make.

The use of screens in the London Hospital is a matter of routine. We do not treat cases without the screen, except in the skin department, where Dr. Sequira has an indicator to count interruptions, using a certain current always with the tube at a certain distance from the part to be exposed to the ray. In that way he gets his dosage. He wants these superficial rays that we do not want when treating carcinoma.

I am very glad to have this opportunity of telling you what we are doing, and I also speak on behalf of the British Electro-Therapeutic Society, of which I am the secretary, and bring you greetings, asking you to join with us in these investigations and to interchange copies of the transactions annually, which surely will be to our mutual advantage and benefit.

Discussion on Dr. Morton's paper.

Dr. George E. Pfahler, Philadelphia: I was very much interested in what Dr. Morton told us. His experiments confirm what we have been doing in this country. A confirmation of results usually helps to establish truth, and I think that ought to be very encouraging to us. I am not sure that sole leather is needed to filter out these surface rays. Two or three gentlemen spoke of having used chamois skin. Perhaps that is enough to use. I used sole leather because I wanted to go a little beyond the skin, but it may be possible that thinner leather than sole leather is sufficient. For instance, and I intended to speak of this this morning, in order to protect my hands I wear ordinary kid gloves, and I am quite sure that they have given my hands considerable protection. I suggest to others who have had trouble with their hands, to try that method. It looks well, keeps your hands clean, and retains a certain amount of moisture the skin is apt to lose because of the destruction of the sweat glands by the X-rays at previous burnings. But in addition to these reasons, I believe that the gloves afford a decided protection to the skin. It is possible that a thin kid leather may be sufficient to protect the skin of the patient. I use sole leather because I want to be sure that I am protecting the skin.

THE CHANGES PRODUCED IN THE KIDNEYS BY ROENTGEN IRRADIATION.

Aldred Scott Warthin, M. D., Ph. D.
Professor of Pathology, University of Michigan,
Ann Arbor, Mich.

The publication during the last two years of Heineke's important work upon the changes produced in the lymphoid tissues by Roentgen irradiation and the observations of Albers-Schönberg upon the disturbances of testicular function similarly produced has effectually disposed of the dictum that had been rather vigorously upheld that Roentgen rays produced changes only in the superficial parts of the body exposed to their action. While other investigators have confirmed the observations of these writers and have added further to our knowledge concerning the changes in the lymphoid tissues and sexual glands, we are still practically ignorant of the effects of Roentgen irradiation upon the other internal organs. The few investigations made along these lines have been rather of the nature of casual incidental observations, and do not lead us to any definite conclusions. Particularly with reference to renal changes due to Roentgen irradiation we are still in the dark, and no thorough investigations have been carried out in this field. In fact, but two observations relating to this subject are to be found in the literature, those of Linser and Baermann and Buschke and Schmidt.

Linser and Baermann (Fortschritte auf dem Gebiet der Roentgenstrahlen, Dec. 9, 1904) found that exposures of one hour produced transitory albuminuria without apparent change in the renal epithelium. Buschke and Schmidt could discover no disturbances of function or pathological changes in the kidneys of guinea-pigs and rabbits exposed percutaneously for periods varying from five minutes to two hours, although some of the animals died during the first week after the exposure without apparent cause. In animals in which the kidneys were laid bare by incision and freed from their fatty capsules irradiation with a medium tube from one-half to two hours produced in some cases a slight albuminuria during the first week. In two cases only were definite histological changes found, the animals dying without apparent cause forty-five and fifty-six days respectively after the irradiation. In the kidneys of these animals extensive necrosis of the cortical substance was found, the necrosis extending even into the medullary pyramids. The neighboring tissues showed a marked reactive inflammation. Other animals similarly exposed lived six to eight weeks showing when killed neither

macroscopic nor microscopic changes in the irradiated kidney.

From these somewhat unsatisfactory and inconclusive experiments Buschke and Schmidt conclude that the kidney epithelium is much more resistant to the action of Roentgen rays than is the epithelium of the testicles. Based upon this comparison they advance the view that cells capable of speedy regeneration are less resistant to the rays, while those more slowly regenerating offer a greater resistance. Since the experiments of Linser and Baermann were practically negative in so far as the production of histological changes in the kidneys were concerned, and as only two of the animals used by Buschke and Schmidt showed pathological changes (and these changes might well be the result of the operative manipulations), it will be seen that at the present time there is practically no conclusive proof that renal changes can be produced by Roentgen irradiation.

The writer was led to the present investigations by the remarkable kidney changes discovered by him in the material from two cases of leukemia that had been treated for some time with Roentgen rays. The first of these cases was a patient of Drs. Brown and Jack of Decatur, Ill. The leukemia was of the myeloid type, the white cells numbering 800,000 and the spleen being greatly enlarged. Roentgen irradiation of the splenic region twice a week for two months produced a great improvement, the spleen becoming reduced in size and the number of white cells diminished. Daily exposures were then made for seven months and the improvement was so marked that hopes of a complete cure were entertained. The patient remained in relatively good condition for six months, although the leukocyte count was high and there was a high percentage of myelocytes. Roentgen irradiation was renewed when there was a change for the worse. The treatment was then continued for seven weeks, but he gradually grew worse and died with symptoms of a severe intoxication. The autopsy was performed by Dr. Jack and the material sent to me for examination. It had been fixed in four per cent formaldehyde solution and was imbedded in paraffin and stained with various stains.

The microscopic examination of sections of the lungs, liver, pancreas, large and small intestine showed atrophy, chronic passive congestion and slight parenchymatous degeneration, but no signs of a leukemic condition. The white cells in the blood vessels were not increased and there was no leukemic infiltration. The spleen did not present

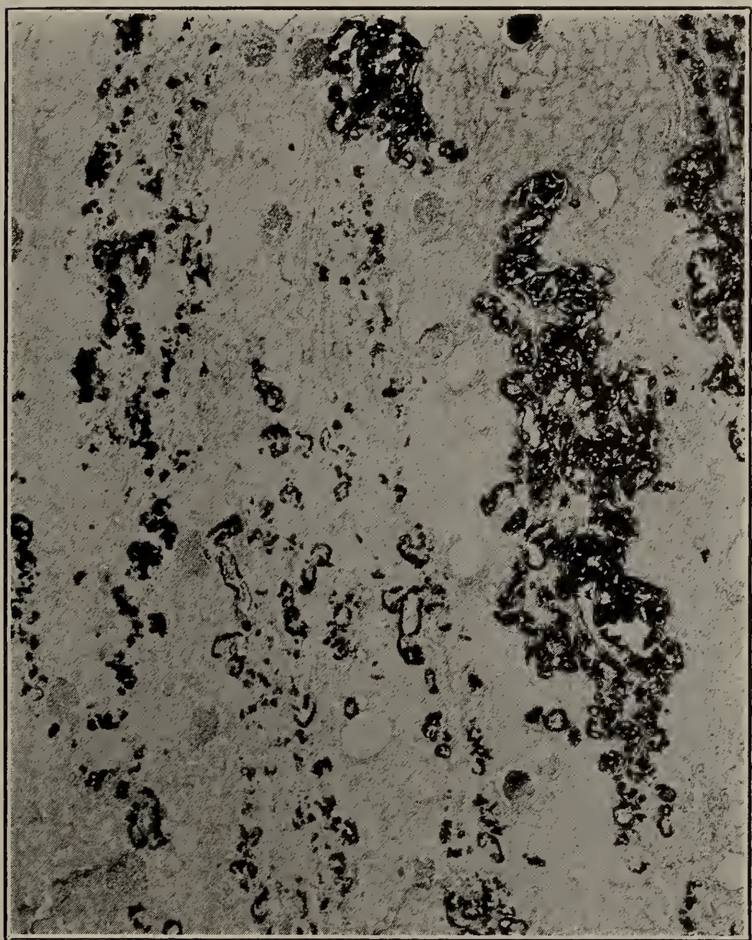


Fig. 1. Calcification of kidney in case of leukaemia treated by Rontgen irradiation. Low power. Haematxylin and eosin preparation. Dark masses consist of lime salts staining deep blue with haematoxylin.

the characteristics of a leukemic organ. Only in the retroperitoneal lymph nodes were changes found suggestive of an intrinsic disease of the blood-cell forming organs. These nodes showed a marked lymphoid hyperplasia, the normal structure of a lymph-node being wholly lost. The lymphoid cells infiltrated the capsule and the surrounding adipose tissue. In so far as the pathological picture was concerned the leukemic condition had been changed into an aleukemic.

Without considering the other pathological features of this case certain remarkable changes in the kidneys demand our attention at the present time. On cutting the kidney into pieces suitable for imbedding a marked grating and resistance was noted. The cut surface showed numerous whitish areas and stripes corresponding chiefly to the medullary rays in the cortex and the collecting tubules in the medullary pyramids. The sections were cut with great difficulty owing to the resistance offered by these whitish areas. When stained the sections showed the presence of extensive deposits of lime-salts filling up the tubules and replacing the renal epithelium. The deposits stained deep violet with haematoxylin and dissolved slowly in one per cent hydrochloric acid without the formation of bubbles. Although found chiefly in the distal convoluted tubules and in the straight tubules the deposits were present also in many of the proximal portions of the convoluted tubules and glomeruli. The remaining portions of the parenchyma were atrophic and presented more or less marked cloudy swelling and fatty degeneration. The intertubular connective tissue was increased and there were localized inflammatory changes throughout the cortex. The blood vessels showed a condition of chronic passive congestion. The extent of the calcification was most remarkable, the greatest part of the renal structure being replaced by the deposits. The condition resembled that sometimes seen after poisoning with mercuric chlorid, etc. When dissolved out the lime-salts left behind a granular albuminous detritus, the renal epithelium of the affected tubules being completely necrosed.

In the second case of leukaemia treated with Roentgen rays similar deposits of lime-salts were found in the kidneys. The patient (Dr. Dock's Clinic, University Hospital) presented universal gladular enlargement with a blood picture of a small-celled lymphatic leukemia. Thirty treatments in all of ten minutes exposures with medium tube, six to eight inches distance, were given every other day to the cervical and axillary regions. The inguinal regions

received nineteen treatments. The enlarged glands became much reduced in size, and there was at first a decrease in the number of leukocytes followed later by a rise. While the general condition seemed at first somewhat improved the patient grew worse and died rather suddenly with symptoms of intoxication. The autopsy was performed by myself. Considering only the kidneys here, they were enlarged, pale and soft. On section the straight tubules of the medullary pyramids appeared as whitish streaks and spots that could be scraped away as finely granular chalky substance having a distinctively gritty feel. On microscopic examination the renal epithelium showed slight degenerative changes and local inflammatory reaction. Cloudy swelling and fatty degeneration were most marked in the distal portions of the convoluted tubules, and in the straight tubules, the lumina of many of these being filled with casts of a finely granular calcium phosphate that, dissolved out with acid, left a granular albuminous cast. In all respects the condition resembled that seen in the first case, but much less advanced.

The extensive renal degeneration and calcification found in these two cases of leukemia treated by Roentgen rays excited at once interest in the question as to the possibility of some relation between these changes and the treatment. That such changes may be found in cases of leukemia not treated by irradiation does not appear in the literature. I have also examined the kidneys from twenty-five cases of leukemia (myeloid, small and large-celled lymphatic, chloroma and the aleukemic forms of lymphocytoma). In all these more or less extensive parenchymatous degeneration was found in the kidneys, as well as leukemic metastases, localized inflammatory changes, etc., but in none was there any deposit of lime-salt seen or such extensive necrosis. In general it may be said that the amount of parenchymatous degeneration found in the kidneys of leukemic cases is in direct proportion to the number of degenerating white cells seen in the blood, spleen, bone-marrow and lymph-nodes of a given case. The most extensive renal changes were found in two cases characterized by marked leukolysis.

The relationship apparently existing between the renal changes and leukocyte destruction as shown by a study of these twenty-five cases may be taken as an evidence that the more severe renal changes in the two cases of irradiated leukemia are the results of some poison arising from this excessive destruction of white cells by the rays. This view is supported by the pathological findings in a

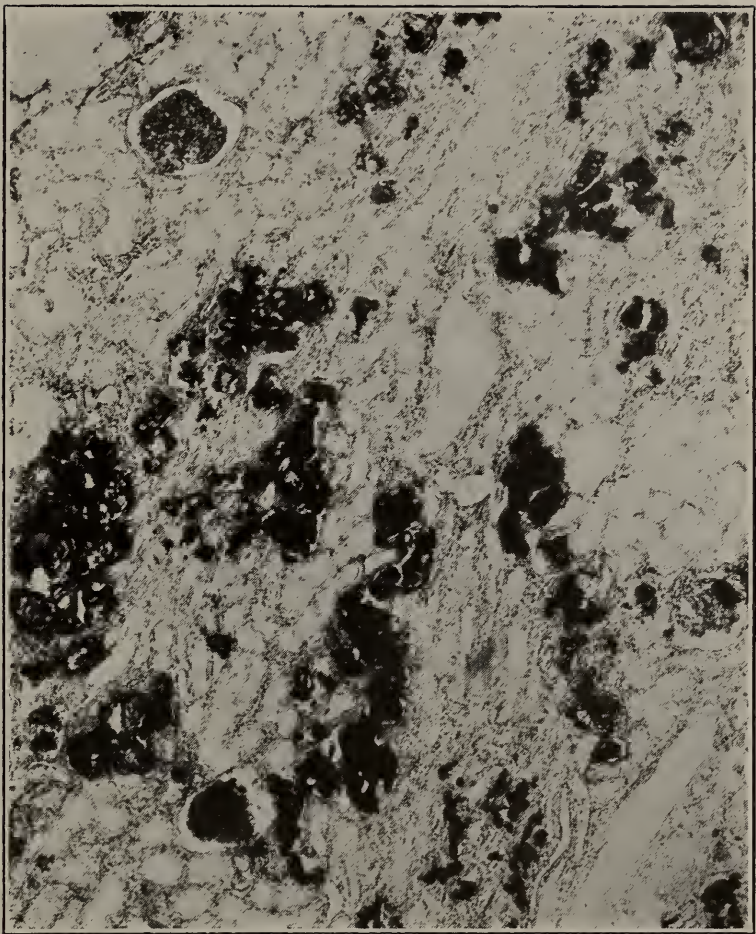


Fig. 2 Calcification of kidney in case of leukaemia treated by Rontgen irradiation. Haematoxylin and eosin preparation. Dark masses consist of lime salts stained deep blue with haematoxylin.

third case of leukemia treated by Roentgen rays. A patient of Drs. Grosh and Stone of Toledo, O., had myeloid leukemia for two years, the white cells being 226,500, and the spleen showing the usual enlargement. He was given five minutes exposures with a medium tube at a distance of six to eight inches for two weeks. The white cells were reduced to 10,600 and the myelocytes from fifty-two to two per cent and the spleen became smaller. The patient then died suddenly with signs of severe intoxication. The various organs presented the picture of a myeloid leukemia with excessive leukolysis. The spleen in particular showed great numbers of disintegrating white cells and numerous areas of complete necrosis. The renal epithelium presented the appearance of advanced cloudy swelling, fatty degeneration and simple necrosis. The blood-vessels were much congested. No deposits of lime-salts were present. The collecting tubules contained numerous hyaline and granular casts.

As it seemed very probable that the extensive kidney lesions in those three cases of irradiated leukemia bore some definite relation to the treatment and the resulting destruction of white cells, it was determined to carry out some experimental work bearing upon this point. The results are given below.

Experimental Investigations.

Technique.—The animals used were white mice and rats, guinea-pigs, rabbits and Belgian hares. Percutaneous exposures were given since all other sources of damage to the kidneys were to be eliminated, and it was also desirable to compare the percutaneous effects of the rays upon the kidneys with those upon the lymphoid tissues. The small animals were placed wholly in the field of exposure, while in the larger ones the field of irradiation was limited to the abdominal region, including the spleen and kidneys. A medium soft tube was used, distance six to eight inches, four inch spark gap, current about 3 M. A., penetration power equal to four M. M. of aluminum. The animals were either killed by being opened under the influence of chloroform or were allowed to die spontaneously. In both cases the organs were removed from the body while warm and fixed at once in a saturated solution of mercuric chloride or in Flemming's solution. In a few cases in which the animal was not seen at death the organs were fixed in a four per cent solution of formaldehyde. With the exception of that fixed in Flemming's all the tissues were imbedded in paraffin and stained with various stains, haematoxlyn and eosin being chiefly used.

Experiment 1.—White mouse exposed one-half hour.

No apparent effects from the exposure. Killed at once. Autopsy appearance negative. The microscopic examination showed nuclear fragments of lymphocytes in the spleen. Very slight changes were found in the nuclei of the renal epithelium, consisting of a slight swelling and vacuolation of the nucleus, the chromatin particles being somewhat more compactly clumped. On the whole these changes were so slight as easily to escape notice, and would not ordinarily be regarded as pathologic or as due to the exposure. Only when viewed in the light of careful control comparisons was the conclusion reached that they were the result of the irradiation.

Experiment 2.—White mouse exposed as above and killed one-half hour after the exposure. The appearance of the kidneys was negative. The microscopic examination showed same slight changes in the renal epithelium. The spleen contained a greater number of disintegrating lymphocytes.

Experiment 3.— White mouse exposed as above. No apparent effects. Killed one hour after exposure. No macroscopic changes in kidneys. The microscopic examination showed numerous disintegrating lymphoid cells in the spleen. The same slight changes were found in the renal epithelium.

Experiment 4.—White mouse exposed as above and killed an hour and a half after exposure. No symptoms. The macroscopic appearances of kidneys were negative. The spleen was enlarged and dark-red. The microscopic examination of the spleen showed great numbers of chromatin fragments throughout the pulp and follicles. The same slight changes in the chromatin of the renal epithelium were found, but appeared less marked.

Experiment 5.—White mouse exposed as above and killed two hours after exposure. No. symptoms. Macroscopic appearances of kidneys negative. Marked nuclear disintegration in the spleen. Microscopic changes in the kidney the same as in the preceding.

Experiment 6.—White mouse exposed as above and killed two and a half hours after exposure. No symptoms. Macroscopic and microscopic conditions in spleen and kidneys same as in the preceding.

Experiment 7.—White mouse exposed as above. No symptoms. Killed three hours and twenty minutes after exposure. Spleen red, slightly enlarged. No macroscopic changes in kidneys. The nuclei of the renal epithelium showed such slight changes as to be practically normal.

Experiment 8.—White mouse exposed as above. No

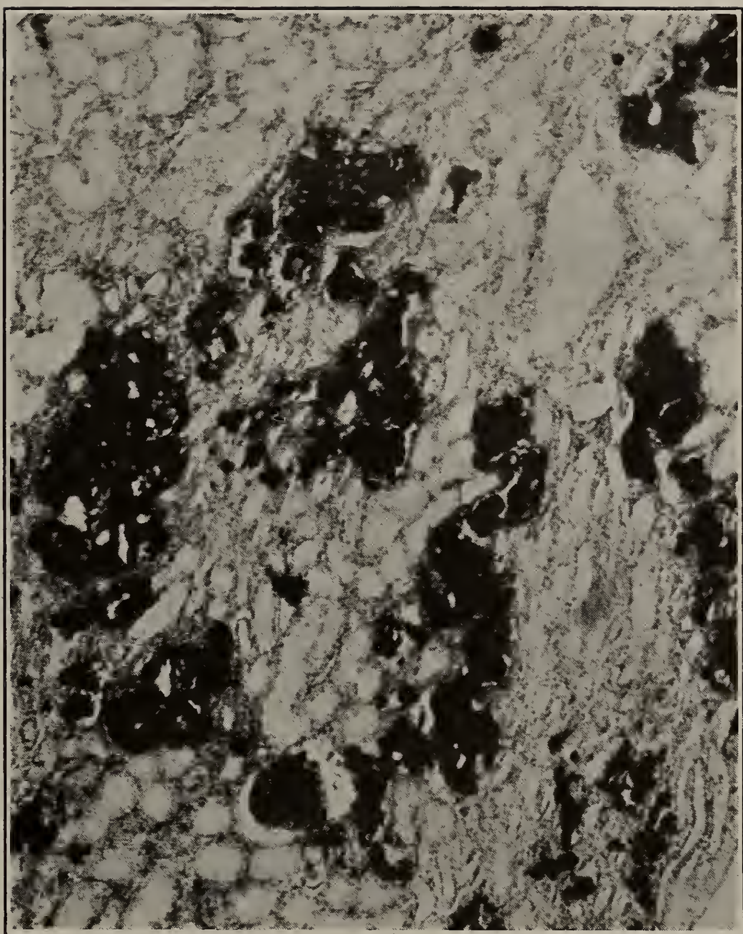


Fig. 3. Higher power view of portion of kidney seen in Fig. 2, showing deposits of lime salts in glomeruli and convoluted tubules. Haematoxylin and eosin preparation.

symptoms. Killed four hours after exposure. Spleen slightly enlarged. No macroscopic changes in kidneys. Microscopic picture same as in preceding, with slightly more disintegration in the spleen.

Experiment 9.—White mouse exposed as above. Four hours after exposure the animal was more quiet than normal and its eye-sight was apparently impaired. Back humped. It was killed five hours after exposure. The spleen was somewhat swollen and brownish in color. No macroscopic changes in the kidneys. Microscopic examination showed slight cloudy swelling of the renal epithelium.

Experiment 10.—White mouse exposed as above. Several hours after exposure became quiet, back humped, eye-sight impaired. Was killed six hours after the exposure. The macroscopic and microscopic pictures same as in the preceding.

Experiment 11.—White mouse exposed as above. Several hours after the exposure developed the same symptoms as in the preceding. Was killed seven hours after the exposure. The spleen was small and browner than normal. The microscopic examination showed slight cloudy swelling of the kidney epithelium. Numerous phagocytes containing chromatin granules were scattered through the spleen pulp, and the number of lymphocytes was diminished.

Experiment 12.—White mouse exposed as above. Same symptoms. Killed eight hours after exposure. Macroscopic and microscopic pictures same as in the preceding.

Experiment 13.—White mouse exposed as above. Same symptoms developed a few hours after exposure. Killed fifteen hours after the exposure. Macroscopic appearance negative. Slight cloudy swelling in the renal epithelium. The greater part of the disintegrated lymphoid cells in the splenic pulp and follicles were collected in large phagocytes.

Experiment 14.—White mouse exposed as above. Same symptoms developed. Was killed twenty-four hours after exposure. Macroscopic appearance negative. Slight cloudy swelling of renal epithelium less marked than in preceding one. Fewer evidences of lymphoid disintegration. Beginning regeneration.

Experiment 15.—Young white mouse exposed for five hours. Almost immediately developed symptoms, shivering, blindness, body damp and cold, back humped, hindquarters paretic. Became comatose and died spontaneously twelve hours after exposure. Body very shrunken, blood

thick, coagulating immediately. Spleen very small and deep brown. Kidneys deep brown, small and dry. The microscopic examination showed great destruction of lymphoid cells in the spleen, lymph-nodes and bone-marrow. The kidney tubules were distended, the epithelial cells smaller than normal, but staining more deeply, their chief nuclei pale and vacuolated. Heavy precipitate of albumen in the tubules.

Experiment 16.—Half grown white mouse exposed for five hours. At the end of the exposure the animal appeared very ill, back humped, eyes closed, body damp and cold, diarrhoea, paresis of hind quarters, etc. Died in twenty-four hours of slowly progressive weakness and coma. Spleen small and dark red. Kidneys small and deep brown. All tissues very dry. Microscopic examination showed marked destruction of lymphoid tissues. The nuclei of the renal epithelium pale and vacuolated, the cell-protoplasm diminished and granular, the tubules distended and filled with a heavy albuminous precipitate.

Experiment 17.—Young gray mouse. Exposed five hours after. Same symptoms as in preceding experiment. Died of paresis and coma forty hours after exposure. Macroscopic and microscopic findings same as in the preceding.

Experiment 18.—Full grown white mouse. Exposed five hours. Developed the same symptoms more slowly and died the third day. Spleen very small and dark red. Kidneys very small and very brown. Microscopic examination showed marked destruction of the lymphoid tissues. The renal epithelium was smaller and stained more deeply than normal and its nuclei showed vacuolation and clumping of the chromatin. The tubules were distended and filled with a granular precipitate of albumen.

Experiment 19.—Full grown white mouse exposed for thirty-two hours and forty-five minutes during a period of five days. Died while being exposed, developing the same symptoms as the preceding. The autopsy showed great distension of the intestines, the peritoneum was very dry, the liver small and brown, and the spleen about one-third normal size and very firm and brown. The kidneys were diminished in size and very brown. The microscopic examination showed the renal epithelium to be smaller than normal, very granular and staining heavily with eosin. The nuclei were pale and vacuolated. The tubules were distended and filled with a heavy granular precipitate. The changes in the kidneys of this case were much more severe than in any of the preceding and were easily recognized.

Experiment 20.—Two white rats, one full grown white mouse, three half grown white mice and one gray mouse were exposed in the same field for five hours. A medium tube was used, backed, six amperes through primary of coil, four inch parallel spark gap, about two M. A. through tube, penetration equal to sixteen M. M. of aluminum. All the animals showed marked symptoms within twelve hours after exposure, similar to those described above. The large white rats seemed more affected than the full grown mouse. The young white mice died within thirty hours, the gray one within forty hours after exposure. The white rats died by the eighth day, the white mouse lived until the tenth day. The autopsy appearances were negative or the same slight changes mentioned above. In the animals dying soon after the exposure the slight nuclear changes were alone found in the kidneys; in the animals dying later the renal epithelium showed a more marked condition of cloudy swelling, the degree of the kidney lesion corresponding in general to the severity of the symptoms and the length of time between the exposure and death, the renal changes being most marked in the animals dying last. Marked destruction of the lymphoid tissues was present in all the animals, but was more extensive in the white rats.

Experiment 21.—Twelve young but full grown white rats were exposed in the same field for five hours under conditions identical with those of last experiment. One animal was killed daily for six days, the others were allowed to die, death occurring in all cases by the eleventh day after exposure. The symptoms in all were identical with those described above, gradually increasing emaciation, paresis and coma. The lymphoid tissues showed extensive disintegration of the lymphoid cells during the first five or six days, the chromatin granules being gathered up by phagocytes and gradually removed after this time. Immediately following the exposure very slight nuclear changes in the renal epithelium were found; in the animals dying later the kidneys were enlarged and congested. The microscopic examination showed a marked cloudy swelling.

Experiment 22-40.—A series of experiments were also carried out with larger animals, rabbits, etc. It is not thought necessary to give the details of these experiments, since they do not differ from those above. The results were similar. Exposures of one-half to one hour produced very minute changes in the renal epithelium apparently quickly recovering. Prolonged exposures causing symptoms, (it is not possible to give exposures sufficiently prolonged to cause the death of the larger animals), were fol-

lowed by a condition of cloudy swelling of the renal epithelium and an albuminuria, in proportion to the degree of destruction of the lymphoid tissue. Two exceptions to this were noted in two Belgian hares, exposures of one-half and one hour respectively causing immediate albuminuria and cloudy swelling.

Conclusions: 1—From the above it will be seen that percutaneous Roentgen ray exposures of small animals for half an hour to an hour produce at once slight nuclear changes in the renal epithelium, characterized by swelling of the nucleus. vacuolation, clumping of the chromatin and some loss of staining power. From this primary injury to the chromatin recovery is prompt, but there follows after six to twelve hours a secondary kidney change characterized by albuminuria and cloudy swelling. This second change occurs during the period of phagocytosis and removal of the lymphoid detritus from the spleen, bone-marrow and lymph-nodes, and appears to be in direct proportion to the degree of lymphoid destruction. It is, of course, possible that this second kidney change is but the result of the primary disturbance of the nucleus, but the first explanation seems to me more probable.

2.—In the case of an animal exposed continuously until death occurs the renal changes are more marked, the renal cells being diminished in size cloudy, and the tubules distended with an albuminous precipitate.

3.—Continuous exposures of five hours or more are invariably fatal to small animals, death occurring within ten days following marked symptoms of paresis and coma, these symptoms also bearing a definite relation to the amount of lymphoid destruction and to the kidney lesion. To what extent these symptoms are dependent upon direct injury to the central nervous system cannot be said at the present time. The character of the symptoms suggests either a primary or secondary damage to the central nervous system. The assumption of a primary injury is upheld by the fact that all small animals exposed for five hours or more became either totally or partially blind. On the other hand, the progressive development of the symptoms some days after the injury is very suggestive of an intoxication, and the character of the symptoms accords with the poisonings due to products of proteid destruction.

4.—If we make therapeutic application of these conclusions it would seem that the destruction of great numbers of leucocytes as occurs in the Roentgen rays treatment of leukemia may be dangerous to the organism, either in its action upon the central nervous system or upon the

kidneys. As to the occasional irradiation of the human body it is hardly likely that any serious damage to the kidneys could result, but in the case of repeated and prolonged irradiation of the lymph-nodes and spleen the possibility of renal injury should be borne in mind. Careful and repeated examinations of the urine should therefore be made in all such cases.

5.—It is probable that the Roentgen rays cause disturbances of the chromatin of all cells, the lymphoid cells and the epithelial cells of the testis being the most susceptible. As compared with these the renal cells are much more resistant. In a general way, then, the view is upheld that all cells capable of rapid proliferation or renewal are especially susceptible to the action of the Roentgen rays.

EXPERIMENTAL AND PRACTICAL APPLICATION OF THE X-RAY IN DISEASES OF THE BLOOD AND BLOOD-FORMING ORGANS, WITH REPORT OF CASES, AND A REVIEW OF THE LITERATURE ON THE SUBJECT.

By Henry K. Pancoast, M. D.

Lecturer on Skiagraphy, University of Pennsylvania, and Skiagrapher to the University Hospital.

The first object of this paper is to report the final results in one of the cases of leukaemia, the case of pseudoleukaemia, and the case of polycythaemia mentioned in the preliminary report last year, and to place on record a case of pernicious anemia and new ones of leukaemia and Hodgkin's disease, together with references as to the results of the metabolism investigations made in connection with some of these cases and in some other diseases. Secondly, an attempt has been made to review the literature concerning the X-ray treatment of leukaemia and pseudoleukaemia especially, but also of other diseases referable to the blood-forming organs, and in addition, references will be made to the practical application of the experimental researches upon the effect of X-ray exposures on lymphoid structures in lower animals. Thirdly, the attempt will be made to show by these references, by the researches of Edsall and others in metabolism, and by statistics, that in leukaemia, especially, the X-ray is not a curative agent *per se,* but by secondarily destroying excessive and abnormal masses of lymphoid tissue and greatly increased numbers of leucocytes in the blood. Nature, or, in other words, the individual organism itself,

is given an opportunity to remove the cause. Lastly, a few instances will be cited showing that X-ray applications in certain grave constitutional disorders are not only dangerous and contra-indicated, but may cause death.

In the review of the literature, the following diseases have been included, and will be discussed in the order named:

Leukaemia, both varieties.
Pseudoleukaemia.
Polycythaemia.
Splenic anemia.
Pernicious anemia.

This task has assumed greater proportions than was realized at the time I was asked to prepare a paper of this kind, and probably a few references have been overlooked. There are about a dozen articles in foreign languages that I have not yet looked up, and will have to be referred to later when this paper is prepared for magazine publication. Literature does not reveal all of the cases that have been treated, and it would be safe to assume that not more than half of the number have been reported. Moreover, many reports are included in discussions or published under titles that give no clue to their existence, and are therefore missed. Unfortunately, it is not the custom of everyone to report failures, even though these are as important for statistics as are the successfully treated cases.

Leukaemia.

Case No. 1. At the meeting last year I reported a case of splenomedullary leukaemia successfully treated by the X-ray for a relapse following about one year after a symptomatic cure under the administration of arsenic. Thirty-one exposures were made during a period of 5½ weeks, and the patient went home apparently well, except that the spleen was still slightly enlarged. She was advised to submit to an occasional exposure as a prophylactic measure. Unfortunately, after the 26th application she developed a dermatitis which resulted in a third degree "burn" that never healed entirely, and always interfered to a certain extent with subsequent treatment. Despite the fact that she received a few exposures during the summer of 1905, she returned 5 months later (Oct. 3, 1905) with evidences of a relapse. Treatment was started at once. At first the application had no effect and the leucocyte count rose rapidly in 10 days from 90,000 to 210,000. The spleen had increased to nearly its original size, but the general condition was better even than when she returned home previously. Fortunately there were soon evidences

of a reaction, and the leucocytes began to diminish gradually. We were not able to bring about a symptomatic cure this time, and after 36 exposures of 8 minutes each to the splenic area and 3 minutes to the knees, during a period of 6½ weeks, she returned home Nov. 19, 1905, to continue the treatment there. When she left, the leucocyte count was 33,400, the spleen was ½ inch below the costal margin (smaller than at any time), and her general condition was unchanged, and only "fair." The trip home sent the leucocytes up to 64,000 the next day, but they fell rapidly under treatment by Dr. G. C. Boughton and the satisfactory domestic surroundings to 11,600 in 5 days, and on Dec. 4 were as low as 10,200. But from then on there was a steady increase, and the last count made by Dr. Boughton, Feb. 3, 1906, showed 77,000. She returned to me Feb. 6 with a 4th recurrence. The spleen was considerably larger, the leucocytes numbered 95,000, and although she had gained in weight, she was weaker. X-ray treatment was started at once, with exposures of 10 minutes each to the splenic area and 3 minutes to the knees almost daily. After 26 applications during a period of 7½ weeks, she returned home again March 31, 1906. The spleen was no smaller, she was much weaker, and had lost considerable weight. The blood condition was:

Red cells, 4,180,000.
Leucocytes, 52,000.
Haemoglobin 80%.

Myelocytes were numerous. After returning home she gradually grew worse, and died June 14, 1906.

Case No. 2. H. A. E. Male, white, 43 years, native of Philadelphia, saloon keeper.

Family History—Negative; no tuberculosis or neoplasms.

Previous Personal History—Had diphtheria once. Severe malarial attack 18 or 20 years ago followed an attack of influenza in February, 1905.

History of Present Condition—

The patient was referred for X-ray treatment for splenomedullary leukaemia by Dr. Musser, Oct. 11, 1905. His only complaint was weakness, but he was still able to work. The spleen was moderately enlarged and the leucocyte count was 96,000. X-ray treatment was started at once. Sixty-nine applications were made during a period of 17½ weeks to Feb. 10, 1906, when a symptomatic cure seemed to have been obtained. The leucocyte count was then 4,200, the spleen was not palpable, and his general condition was altogether normal, his weight hav-

ing increased to his standard, and he felt as well as he ever had before. Unfortunately, no differential count was made to determine the presence of myelocytes. The leucocyte count began to rise slowly from this subnormal point and numbered 6,640 on March 8. He was told to return in three weeks, and on the 29th the count was 16,000 leucocytes. From previous experience this was taken to indicate the starting point of a recurrence, and X-ray treatment was resumed. In 4 weeks, after 10 applications, the white cells were reduced to 11,000. From this time (May 24) there was again a rise, and despite vigorous treatment this continued, and by June 27, after 11 more exposures, the leucocytes numbered 53,000. Then a reaction began and since that date there has been a gradual irregular decrease to 14,600 when I made the last exposure before coming away on my vacation. During this relapse the spleen has been palpable at times on deep inspiration. The patient has felt perfectly well and continues to gain in weight. About 108 exposures have been given to this patient during a period of 43½ weeks without causing dermatitis, and this I ascribe to the use of the wet leather filter devised by Dr. Pfahler. A *cure* has not been obtained, nor do I expect a permanent one, but shall endeavor to prolong the life of this patient in comparative comfort just as long as the treatment tends to control the disease. The detailed leucocyte count follows:

November 2, 1905	....	44,000	
9 "	....	56,000	
16 "	....	56,000	
23 "	....	51,000	
December 15 "	....	31,000	
22 "	....	26,400	
28 "	....	21,000	
January 4, 1906	....	19,500	
12 "	....	15,200	
19 "	....	14,400	
25 "	....	10,200	
February 8 "	....	6,200	
10 "	....	4,200	Treatment stopped.
22 "	....	5,100	
March 1 "	....	6,280	
8 "	....	6,640	
29 "	....	16,000	Treatment resumed.
April 5 "	....	10 600	
12 "	....	20,400	
17 "	....	12,400	
24 "	....	10,720	

May 4	"	12,000	
8	"	14,000	
16	"	14,200	
19	"	12,560	
24	"	11,200	
27	"	12,960	
June 6	"	14,000	
9	"	15,760	
11	"	15,200	
16	"	22,000	
18	"	21,200	
20	"	23,560	
22	"	........30 640	
24	"	19,000	(?)
27	"	53,000	
29	"	57,500	
July 1	"	41,660	
2	"	23,000	No treatment since June 27.
5	"	24,660	
7	"	........25 000	
9	"	23,300	
11	"	22,600	
13	"	22,000	
16	"	20,600	
18	"	27,300	
20	"	17,600	
23	"	22,600	
25	"	........18 300	Changed to a harder and black tube.
27	"	13,600	
30	"	24,300	
August 1	"	21,500	
3	"	15,000	
6	"	14,600	

In reviewing the literature on leukaemia, I have collected 123 cases treated by the X- ray, and this represents the greater bulk of the reports, but a few more articles yet remain to be examined.

Summary.

Splenomedullary cases reported in literature..................	80
Splenomedullary cases reported by letter....................	3
Lymphatic cases reported in literature......................	30
Unclassified cases reported in literature.....................	10
Total	123

The primary results obtained by the treatment were as follows:

	Spleno-medullary.	Lym-phatic.	Unclass-ified.	Tots.
Symptomatic cure	33	11	3	47
Improved	22	8	2	32
Improved and still under treatment	14	1	0	[illegible]
Not affected or but slightly improved	13	10	3	26
Report of result not obtained	1	0	2	3
Totals	83	30	10	123

Of the 123 cases included in the table, final reports have been received or found of 63, or slightly more than 51 per cent. The following table shows the final outcome or present condition of these patients:

	Spleno-medullary.	Lym-phatic.	Unclass-ified.	Tots.
Still living and well	2	2	0	4
Symptomatic cure, relapsed, died	11	5	0	16
Symptomatic cure, relapsed living but condition very grave	5	0	0	5
Improved relapsed, and died of the disease or an intercurrent infection	14	3	1	18
No effect, or but slightly improved, and died	5	8	3	16
Symptomatic cure, relapse, and under treatment at the present time	4	0	0	4
Totals	41	18	4	63

Out of the 123 cases mentioned, the final outcome or present condition has been ascertained from the reports or replies to letters of inquiry in 63. Out of these 63 patients, only *four are alive and well today,* and represent only about 6 1-3 per cent. One of these, of the spleno-medullary variety, treated by Schultz, had been well in 1905 without relapse, for 4 years. Burdick's case cured in 1900 had a relapse in 1902, and has remained well to the present time, and his lymphatic case cured in 1002 has been in good health since a relapse in 1904. Senn's case of the same variety was cured in 1903, and has remained so. The death rate of these 63 cases is 55, or 87 1-3 per cent. and four other patients, or 6 1-3 per cent, are in practically a dying condition.

It may be of interest to note that two cases of spleno-medullary and one of lymphatic leukaemia have died during treatment as a result of toxemia, one of each variety died of intercurrent pneumonia, one case of the spleno-medullary variety died of tuberculosis, one with meningeal symptoms, and one with symptoms resembling those of spinal hemorrhage.

In connection with these facts. it may be remembered that intercurrent infections are frequently responsible for

spontaneous improvements in leukaemia and pseudoleukaemia. Neutra (103) in 1903 had collected 19 recorded cases in which there was a marked reduction in leucocytes during and after an intercurrent infectious disease. He stated that there was never any improvement in the general condition, and believed that the reduction was due to a destruction of leucocytes by the toxins of the intercurrent disease, and not to any improvement in the leukaemia.

The above statement of results is certainly not very encouraging. In view of the high death rate, the frequency of relapse, and the results of experimental research, the X-ray is certainly not a specific therapeutic agent in either variety of leukaemia. Although its influence in rapidly destroying enormous numbers of leucocytes in the blood, in reducing to a normal or nearly normal size a spleen of tremendous proportions, and likewise similarly affecting the enlarged glands, is obvious to all of us, nevertheless, the true cause of the disease is evidently not destroyed, and a relapse is to be expected sooner or later. However, the mortality is no higher than by any other form of treatment, and we can usually be reasonably certain, if the case be not too far advanced, of at least prolonging life. It seems to be generally accepted that no case of splenomedullary leukaemia can be considered cured while myelocytes remain in the blood.

The dangers attending the use of the X-ray treatment should be well borne in mind, and examinations of the urine carefully made, and symptoms of toxemia looked for. The evidences are very numerous in literature of death having been hastened by failure to observe these points. Because of the autopsy findings in a few cases of leukaemia it has been claimed that the X-ray may have a degenerative action upon the kidneys in the treatment of such conditions. But there are no facts mentioned in literature to substantiate this belief. The changes in the kidneys in the few autopsies that have been made were in all likelihood due to the X-ray only secondarily, and were really to be expected.*

As to the way in which X-rays act in leukaemia, this question was dealt with in the paper I presented last year, and there has been plenty of evidence in literature to support it. There have been three theories of importance advanced in regard to the reaction found in this disease. 1. At first, Senn and Ahrens claimed that the rays inhib-

* As the paper by Dr. Warthin covers this subject thoroughly, the further notes upon renal changes will be omitted from this article.

ited the development of or actually destroyed a *hypothetical* parasite of leukaemia. 2. Others have claimed that the rays exert an inhibitory action upon the blood-making organs, and do not cause a destruction of cells in these organs. 3. The theory of an autolytic action seems to have the best support, and in addition there may be a direct action upon lymphoid structure, but this is not proven.

PSEUDOLEUKAEMIA.

Case No. 5. *Pseudoleukaemia.* M. P., male, 42 years, married, native of Austria, occupation store clerk. Referred by Dr. M. H. Fussell, medical dispensary. The patient was admitted to the dispensary Sept. 26, 1904.

Family History: Negative. No tubercular history.

Previous History: None of the diseases of childhood. He has suffered with dyspepsia for 22 years, and attributes this to fasting for 3 months, eating only a loaf of bread one day during each week, in order to reduce his weight below the standard, and thus avoid army conscription. After this fast he had an abnormal appetite, which has continued more or less ever since. About seven years ago he began to have some trouble with his foot, and about 18 months ago he received 21 X-ray applications and was cured, and has had no further trouble with it. He says he was told he had a sarcoma of the skin.

History of Present Trouble: For a year he has been feeling weak and has been confined to bed several times in consequence, and on account of dyspepsia. Six months ago he consulted a stomach specialist, who did nothing for this condition, but discovered that the spleen and the cervical, axillary and inguinal lymphatic glands were enlarged, and the blood examination revealed an anemia. He was treated with bone marrow and arsenic for about a month and the glandular swellings disappeared. During the past week the spleen and glands have again enlarged.

Condition on Admission: Complains of weakness, slight dizziness, dyspepsia, edema of the ankles and puffiness of the lower eye-lids at times. No dyspnoea, appetite good, bowels regular. The tongue is heavily coated. The urine contains a trace of albumen, but is otherwise negative. Considerable edema of the legs and ankles, which is less in the morning. The thorax is negative, except for a possible impairment of resonance over the right apex. The spleen extends from the eighth rib in the mid-axillary line above to an inch and a half below the costal margin, and is movable. The stomach is ptosed,

and by inflation extends downward to the umbilicus. The right kidney is movable. The liver is not enlarged. All superficial lymphatic glands are enlarged as follows:

Submaxillary, the largest—Size of a walnut.

Post-cervical—Slightly.

Supra-clavicular—Slightly.

Both axillae and epitrochlear—Latter the size of a pea.

Both inguinal—Size of a lima bean.

One gland in the dorsum of the penis behind the corona—The size of a large pea, but flat.

One gland in the right popliteal space.

Treatment: Arsenic and bone marrow, and continued one month.

X-ray treatment was started Oct. 7, 1904 and during the remainder of the year 48 applications were made. Each time the tube was placed over the abdomen, then over the thorax, including the axillae and one side of the neck, and then over the inguinal regions. The exposure over each area lasted 2 to 5 minutes, with the anode 14 to 16 inches from the skin. These exposures may seem short, but in reality they were severe, as an electrolytic interrupter was used and a primary current of from 5 to 15 amperes, forcing a secondary current of from 1 to 2 milliamperes through a hard tube with a vacuum equivalent to 3 to 5 inches of spark gap resistance. It was known that the superficial glands would absorb fewer rays than from a softer tube, but they evidently absorbed enough, and we were after the deep-seated glands that must also have been enlarged. Later, when a mechanical spring interrupter and less primary current were used, the exposures were made longer. After receiving these 48 applications, all the superficial enlargements except the nodule of the penis, were considerably reduced in size. The spleen varied and the changes in size were rapid, an increase in size being usually accompanied by an attack of indigestion. From Jan. 4, 1905, 19 additional applications were made up to Feb. 7, when the only glands still enlarged were the post-cervical (slightly), the left parotid lymphatic and the inguinal, which were still considerably enlarged. The nodule on the penis remained the same. The stomach was still ptosed, and the liver also, but not enlarged. The spleen extended from the ninth rib above to the level of the umbilicus below, but could be pushed up under the costal margin, and then the splenic dullness extended upward to the eighth rib. The general condition was considerably improved. Treatments were continued three times a week until March 31, 1905, making

21 additional applications. These were made as often and as severe as the skin would allow. From this time until May 12 there were 10 exposures, or twice a week. He then developed a mild erysipelas of the right leg, accompanied by a marked enlargement of the suphenous glands on the same side. This condition subsided in about 10 days and treatments were resumed May 23, and continued once a week until July 3. The spleen was then larger, and he had had an attack of indigestion for two weeks. He did not return until August 5, and was then feeling much better, and a few days later the spleen was barely palpable. From this time until October he came back but three times and has not been seen since. At the time of the last visit the spleen was nearly normal in size, most of the glandular enlargements had disappeared, and those remaining were much reduced in size, but both the spleen and glands varied at intervals. He had no cough, but a slight dullness was found at the right apex, and he had some pain in the right side of the chest. There was puffiness in the lower lids. His weight was 127½ pounds, 130 being normal. He was emaciated in appearance, but was probably always so, and the skin was sallow. On account of his weakness it cannot be said that the general condition was due to phthisis or to the splanchnoptosis would seem to indicate. In all, he received 107 X-ray treatments during a period of one year.

We cannot record this case as a "cure," and the most that can be said is that we brought about a considerable improvement symptomatically. Evidences of the disease certainly still remained, and whether or not the general condition was due to phthisis or to the splanchuoptosis and accompanying gastric disorder cannot be stated definitely. I do not believe that the patient is still living, but if he is, he has either gone to another institution for treatment or is to be considered a hopeless invalid.

Case No. 6. *Pseudoleukaemia.* Mrs. A. W., female, 40 years, native of Pennsylvania, married. Referred by Dr. J. M. Spellissy.

Family History—Negative. No neoplasms, anaemias, disease of the thyroid, nor tuberculosis.

Previous History—Negative.

History of Present Condition—In November, 1905, the patient noticed a swelling in her neck over the suprasternal notch. It was painless and soft at first, but grew progressively upward and to the right and became firmer, and

soon began to cause difficulty in swallowing and breathing. She began to lose weight and strength as soon as the swelling was noticed. In March, 1906, the pressure had become so great that she could not lie down on account of dyspnoea, and could swallow soft food only. By this time she had lost 35 pounds in weight. On March 12 she was operated on by Dr. Spellissy for what was supposed to be a malignant growth of the thyroid or cervical lymphatic glands, or possibly a local manifestation of Hodgkins' disease. The mass in the neck was removed partially under local anaesthesia, as a general anaesthesia was contra-indicated on account of the dyspnoea. After incising the neck a chain of dense lymphatic glands lying upon the internal jugular vein was removed from the mastoid process to about one and one-half inches below the sternal notch. The opening up of the neck relieved the dyspnoea and the operation was finished under ether. Below this mass and an inch and a half below the sternal notch, glands of the same character were felt, but could not be removed without splitting the sternum, and their further treatment was deferred until the pathologist's report should be received. Dr. Longcope examined the specimen and pronounced the growth to be a localized lymphatic enlargement due to pseudoleukaemia. It was then thought advisable to submit the patient to X-ray treatment.

I saw her three weeks later and concurred in this opinion, as it seemed to offer the only chance, though a remote one, of curing her, but would at least probably prolong her life. There was a sinus still persisting in the line of the scar and probably due to a lateral ligature of silk on the jugular vein. Immediate treatment was advised, but the patient felt much better and wished to return home first, promising to come back in a few days. She did not return until June 27, 15 weeks after her operation. About the end of April, or six weeks after the operation, she noticed a recurrence of the growth in the suprasternal notch, and it grew steadily upward and to the right, and soon caused a return of pressure symptoms. When she returned to me, the mass was about the size of an egg and firm and immovable. It was necessary for her to sleep in a semi-recumbent posture on account of extreme dyspnoea, and she could swallow soft food only. The right pupil was dilated. She was again losing weight. Examination of the chest revealed dullness over both apices and extending further down on the right side. A skiagraph made July 3 shows the extent of the intrathoracic portion

of the growth.

A single X-ray exposure was given June 27, and then after consulting with Dr. Ralph Pemberton it was decided to carry out Dr. Edsall's metabolism investigations on this case, which seemed particularly suitable on account of the very large and localized mass. From this date until July 4 "placebo" applications were made with a punctured tube, as it was necessary to have a preliminary control period on the special diet without X-ray exposures before the treatment was begun in earnest, and the patient was unwilling to submit to any delay. She was admitted to the University Hospital on the service of Dr. Tyson June 29 and was at once placed on the special diet used in the investigations in the leukaemic cases previously reported. The blood examination showed:

Red cells,	4,880,000.
Leucocytes,	7,760.
Haemoglobin,	55.00 per cent.
Polymorphonuclears,	82.00 per cent.
Lymphocytes,	12.00 per cent.
Large mononuclears,	4.00 per cent.
Transitionals,	1.33 per cent.
Eosinophiles,	0.67 per cent.

The total 24 hours' urine of three days was examined during the preliminary control period, but not until four days had elapsed after the first short X-ray exposure, so that the results would not be influenced thereby.

X-ray exposures were begun July 4 and continued daily except Sunday until August 1, making 26 applications in all. She then returned home for a few weeks. The exposures were made over the neck and thorax in front, the rest of the body being protected, and a wet filter was used over the exposed area. The average duration was about 14 minutes from a medium tube of 2 to 3 inches spark resistance, with the anode 10 to 12 inches from the skin. A mechanical spring interrupter was employed and a secondary current of 1½ to 2 milliamperes used. There was a marked erythema at the time we stopped the treatment. There has been a decided and progressive improvement in every respect since beginning treatment. After a very few exposures she was able to sleep in a recumbent posture and on either side, and now she has no dyspnoea, even when going upstairs. The blood count made July 8, the day she left the hospital, showed:

Red cells,	4 240,000.
Leucocytes,	6,560.
Haemoglobin,	62 per cent.

Polymorphonuclears,	81 per cent.
Lymphocytes,	6 per cent.
Large mononuclears,	6 per cent.
Transitionals,	6 per cent.
Eosinophiles,	1 per cent.

The portion of the growth in the neck has now diminished in size and is softer. Dullness is not so pronounced in the regions of the apices, and the breath sounds are more nearly normal. By comparison of the skiagraph made a few days after beginning treatment, with the one made after the last exposure, we find some reduction in the size of the intrathoracic portion of the growth, amounting to about 3/8 of an inch in the width of the shadow. Along with this rather slight but encouraging decrease in size there must have been considerable reduction in density to account for the marked improvement in pressure symptoms. While she has been under observation there has been no elevation in temperature. The respirations have been slightly increased (20 to 24) and the pulse was accelerated at first averaging about 100, but has now come down to normal.

In the metabolism investigations the total output of nitrogen, uric acid, chlorides, and P_2O_5 was estimated. For the first 24 hours after the treatment was started the waste tissue products showed, with the exception of nitrogen, a *decrease* below the average of the preliminary control period, but on the second day there was a recovery, and the average for the first four days of treatment showed an increase in P_2O_5 and nitrogen, and a decrease in uric acid and chlorides. The patient was discharged from the hospital July 8 after these investigations were finished and readmitted July 24 and again placed on the special diet and the waste products estimated for three days, July 27 to 29. The average percentage of increase or decrease over the preliminary control period is shown in the accompanying table:

By comparison of these results with those of the investigations in leukaemia reported last year, we find a decided contrast. In the typical case of pseudoleukaemia there is no evidence of an excessive tissue destruction, neither during the first few days of X-ray treatment nor during the third week, by which time there had been a recognizable decrease in the size of the large mass. Moreover, what little increase there was in elimination did not appear at once as in the second leukaemia case. In our Hodgkins' case the increase in elimination of waste tissue products is no more than we would expect to find during

the slow destruction of any other variety of growth of like size responding to X-ray treatment, but the increase *manifested itself earlier*. The results in pseudoleukaemia differ on the one hand from those in leukaemia, in which the treatment not only causes a reduction in the size of an enormous splenic tumor, but also we are presumably stimulating an antolytic process which may or may not cause the reduction of the splenic mass, but at least institutes an *almost immediate* destruction of enormous numbers of leucocytes circulating in the blood. In contrast with a carcinoma on the other hand, the evidences of tissue destruction are manifest much earlier in pseudoleukaemia, and the experimental investigations of Heineke and of Warthin explain the reason.

The researches of Heineke (91) were undoubtedly the most valuable investigations in X-ray pathology up to the time of his report, and form the basis for our present knowledge of the action of the X-ray upon lymphatic structures. He found that the exposure of guinea pigs for several hours to the rays almost invariably resulted in death, and the white cells of the bone marrow and all lymphoid structures were destroyed, and the process was analogous in all these tissues. In the bone marrow, for instance, the process started at nearly the third hour, reached its height at about the eleventh hour, and terminated by the end of the fifth or sixth day. He determined that in a rabbit or moderate-sized dog the minimum exposure necessary to institute any degenerative changes was 15 minutes. The lymphocytes were always the first to react. All these changes occur without any reaction of note in the skin. The reaction of the lymphoid tissue of man is not so prompt nor so decided. He deduces the important fact that when tumors of lymphatic origin regenerate or recur elsewhere after an apparent disappearance or destruction, and X-ray treatment is suspended, it goes to show that although the principal manifestation of the disease has been eliminated, the treatment has not reached nor removed the cause. This statement has an important application in the treatment of leukaemia and pseudoleukaemia, in which relapses following apparent cures are so very common.

About the same time, but independently of Heineke, Warthin (92) made similar researches and obtained practically the same results. He observed changes in the lymphocytes in the spleen within 14 minutes after an exposure of half an hour, and found that disintegration continued for several days. As in Heineke's experiments, exposures of five hours or more caused death in from two to five

days, and always before the eleventh day. He found that white rats were especially susceptible. The action upon lymphatic glands was similar, and repeated short exposures caused ultimate necrosis, but it was possible for regeneration to take place if the applications were discontinued. The reaction of bone marrow was much less marked, and single short exposures produced no perceptible changes.

It is evident, therefore, that the lymphatic structures are not only the most susceptible of any tissues in their reaction to X-rays, so far as we know, but also destructive changes may begin almost immediately after exposure. The sudden and remarkable increase in elimination of waste tissue products in leukaemic patients so treated can be explained by the autolytic action upon the leucocytes of the blood, but whether the destruction takes place in the lymphatic structures alone, especially the spleen and bone marrow, or also in the blood, cannot be said to have been definitely proven. The researches of Smith and Capps (93) would tend to prove that the blood did, under such circumstances, contain an autolytic agent. In pseudoleukaemia the exact cause of destruction is more difficult to determine. It if were dependent upon autolytic action alone, as is the cause of lymphoid degeneration assumed from Heineke's experiments, it would be expected that there should be a marked decrease even below normal of the leucocytes in the blood of a patient treated for generalized lymphatic enlargements in pseudoleukaemia, but such is not the case.

A third case of supposed Hodgkins' disease was treated this year and metabolism investigations made in connection therewith.

Case No. 7. T. C. D., male. 45 years. He presented marked enlargements of the glands on each side of the neck, causing great pain and considerable dyspnoea, and showing a tendency to soften. There was also an enlarged gland in the epitrochlear region of the left arm. The patient was very weak and emaciated, and the blood examination showed a symptomatic anemia. X-ray treatment was started May 14, 1906, and he was given four daily exposures of 8 to 10 minutes to the neck and one to the spleen. After this his general condition and the pressure symptoms demanded more radical procedures, and most of the enlarged cervical glands were excised. The pathologist reported the condition to be tubercular adenitis. The case is of interest only because the metabolism investigations showed practically no change in the elimination

of waste products under X-ray treatment.

In reviewing the literature on pseudoleukaemia, 40 cases have been collected in which X-ray treatment was used, and this represents nearly all the references to be found. A few more cases may be added when a small number of additional articles are examined. In reply to letters concerning the subsequent histories of patients previously reported, some writers have made mention of a few additional cases, which will be included in the summary. As in leukaemia, the reports do not include perhaps more than half the cases treated, and for the same reasons.

Summary of the 44 cases reported:

Cases reported in literature	40
Cases fully reported by letter	4
Total	44

In all but two of these cases, the primary results obtained by the treatment have been found, and are as follows:

Symptomatically cured	18
Improved	14
Not affected, or improved but slightly	10

Of the 44 cases included in the table, final reports have been received or found of 29, or 66 per cent. Three patients are known to have disappeared during or after treatment, and the authors have no knowledge as to their subsequent histories or whereabouts. Final reports of the remaining 12 cases could not conveniently be obtained at present.

Out of the 29 cases in which the final outcome or present condition are known, 7 are still alive and well three to four years after the first symptomatic cure, and 1, one year afterward. Seventeen have died of the disease actually, or as a result of it, and 2 more will probably die soon. The remaining two cases are still under treatment. At least four of the patients died during relapses, and four of those still living have had relapses.

In conclusion, out of 29 cases reported fully to date (or 66 per cent of the total number) 24.1 per cent are alive and well three to four years after the first symptomatic cure, and altogether 27.6 per cent. are alive and well; 65.5 per cent are dead or will soon die, and 6.9 per cent are still under treatment.

It may be of interest to note that at least three cases have died as a result of toxemia induced by the treatment, two have died of peritonitis following intestinal perfora-

tion, one of tuberculosis, and one of inspiration pneumonia following an operation for removal of glands in the neck.

The results of X-ray treatment of this disease are not, I think, as encouraging as most of us had believed, but they are very much better than in leukaemia. In view of the high death rate, the frequency of relapses, and the results of experimental research, the X-ray can hardly be termed a specific therapeutic agent in pseudoleukaemia. However, it certainly has a marked influence upon the disease, and the general condition of the patient generally improves to such an extent that a symptomatic cure may frequently be obtained. But the cause is probably not removed by the X-ray, and if the patient remains well, the treatment has brought about such a favorable state of affairs that the etiological factor disappears through some other agency. The points in favor of this treatment are:

1. A cure for at least two to four years in something like 25 per cent of cases treated.

2. Life is prolonged by improvement in the general condition and by relief of pressure symptoms during a period of comparative comfort.

3. No other therapeutic agent is capable of as good results.

4. By further improvement in technique and better understanding of the pathology, even better results are possible.

The first report of a case of pseudoleukaemia treated by the X-ray was made by Pusey (6) in January, 1902. Later in the same year, Stover, Hett, Dunn and Childs also reported cases. From then on the references in literature are numerous and frequent.

Polycythaemia.

The literature concerning any form of treatment of this condition is scarce, and I have found records of four cases only treated by the X-ray. There have been undoubtedly numerous other cases so treated and not reported because of the failure to accomplish any good results. The administration of arsenic and splenectomy seem to be the methods more generally employed, while deprivation of iron, venesection, and radiotherapy (98) are among the other measures that have been tried. The results cannot in any case be said to be very favorable. Turk (94) reports seven cases with enlarged spleen, in only one of which was there any improvement. This patient was treated with arsenic, which was administered with the idea that it checks the proliferation of the blood-forming tissues

as in splenomedullary leukaemia. In one of Heineke's early reports (95) of his experiments, he states that after prolonged exposures there were evidences in the spleen of a destructive action of the rays upon the red corpuscles.

In the absence of more definite knowledge, it would seem that the splenic area at least is the proper one for X-ray exposures in patients so treated. Pfahler (96) last year reported one case under X-ray treatment, with improvement while continuing the exposures. Eichberg (97) states that Joachim and Kurjuwet have reported two cases so treated, and last year I made a preliminary report of one case under my care (28). As a detailed report of this case will probably be published later, I shall mention simply the further progress under X-ray treatment:

Case No. 8. W. B., male, 22 years. Referred by Dr. Stengel, May 13, 1905. Red cells were over 10,000,000, marked cyanosis, slight dyspnoea, general weakness, slight enlargement of the spleen. Fifty exposures of 5 to 10 minutes each were made over the splenic area from May 13 to Sept. 24, 1905, after which the preliminary report was made. A hard tube was used, with the anode about 12 inches from the skin. Up to that time his general condition was improved, he felt stronger, and the blood count varied from 8 to 9½ millions. From Sept. 24, 1905, to the present time he has received 70 additional exposures, averaging two per week regularly until July 21. The count was as low as 7,110,000 in May, and the patient then felt fairly well, but was still weak. When last seen, August 4, he was in about the same condition as when first treated, and the question of splenectomy was being discussed. He has never had any other form of treatment than the X-ray, and has been working continuously while under our care. The accompanying table for our own reputations and protection we have the right to demand a satisfactory report from the clinician referring the patient to us, and for the same reasons applied to himself he should be careful to give one. No more than this is required by the surgeon before he orders the anaesthetic administered to his patient. Dr. Edsall has given this advice to the clinician, and I take the liberty of putting it in proper form to be received by the X-ray specialist. shows the blood counts since the last report:

September	16,	1905	7,950 000
	30	"	6,800,000
October	7	"	8,200,000
	21	"	8,250,000

November 18	"	7,600,000	
27	"	8,200,000	
January 6, 1906		9,220,000	
13	"	8,800 000	
22	"	8,800,000	
February 3	"	8,800,000	
10	"	10 000,000	
24	"	9,240,000	
March 5	"	8,800,000	
10	"	8,500,000	
17	"	8,240,000	
24	"	8 160,000	
April 7	"	9,030,000	
28	"	7,720,000	
May 12	"	7,110,000	
June 2	"	8,390,000	
9	"	7,420 000	
23	"	9,430,000	W. B. C., 10,320. Haem., 135%.
30	"	9,080,000	
July 7	"	7,960,000	
14	"	8,725 000	
21	"	8,920,000	
August 4	"	10,020,000	

Splenic Anemia.

In going over the literature on the other conditions included in this paper. I have collected reports of 12 cases of splenic anemia treated by the X-ray. Bozollo (99) has treated three cases, with some improvement, though the reaction has been slow. Pulley (100) reports two cases improved. Schirmer (101) refers to four cases improved. Krause (59) treated three cases, with improvement of the blood condition, but the spleen was not reduced in size.

Pernicious Anemia.

So far as I know, five cases of pernicious anemia have been treated by the X-ray. Renon and Tixier (102) report one case in which the X-ray was used in conjunction with diphtheria antitoxin. The disease was of 18 months' duration, and the patient a woman 68 years of age. After three months of combined treatment, the red cells rose from 880.000 to 2.405,000 and the leucocytes from 2,000 to 4,000, and her general health was considerably improved. As the reaction to each agent was found to decrease gradually as treatment progressed, they were used alternately with better results. The substance of their theoretical grounds was that the bone marrow was stimulated by leu-

coylysins due to X-ray destruction of leucocytes, and by hemolysins formed by the action of the antitoxin.

Last year I referred to two cases treated at another hospital in Philadelphia. In one there was rapid and marked improvement under X-ray applications, followed by a relapse one year later, but again responding rapidly to the same treatment. This patient is probably still alive. The second patient, who showed evidences of an intoxication, received one exposure of 8 minutes over the thighs, and this was followed in a few hours by alarming symptoms, terminating in death in 2½ weeks. At this same hospital, strange to say, a third case has been treated lately, and when last heard of, the patient was improving.

In November, 1905, I was induced to try the effect of the rays on a case of pernicious anemia referred by Dr. Stengel. Realizing the dangers of such a procedure, the exposures were to be exceedingly short, and Dr. Edsall had the case under observation for the effect upon metabolism. The patient, a male, aged 38 years, had a blood count near 1,000,000 red cells, some elevation of temperature, an irritable stomach and was considerably prostrated. The elimination of waste tissue products during a preliminary control period gave evidence of toxic tissue destruction. On Nov. 11 I gave him one exposure, lasting only 4 minutes, over the abdomen, using a hard tube of 4 inches spark resistance, with the anode 12 inches from the skin. A mechanical spring interrupter was used, and the secondary current was one milliampere. In three or four hours he had a chill and vomited, the temperature rose to 103, and for several hours he was alarmingly ill. During the first 24 hours the elimination of tissue products was reduced about 50 per cent., and during the second 24 hours, while he was recovering, the nitrogen and P_2O_5 rose markedly, but did not reach the average point of the preliminary control period until the third day. The uric acid did not recover for four or five days. The patient died three weeks after the one exposure, which was not repeated.

These facts are worthy of serious consideration. While not believing that X-ray exposures are absolutely contra-indicated in pernicious anemia, I shall hereafter be emphatic in my refusal to treat, or even skiagraph except for urgent necessity, such a patient unless metabolism investigations are carried out in conjunction, and the individual does not show evidences of a toxemia and does not react to other forms of treatment. It is not always possible to study the metabolism in our patients, and, in fact,

for many of us it will be impossible, but Dr. Edsall thinks that as a rule the estimation of the uric acid, accompanied by a careful urine analysis, will answer, and this is the easiest and quickest of determination of all the products.

In connection with this subject it may be well to mention some facts concerning another of Dr. Edsall's cases. A patient with rheumatoid arthritis was given a few minutes' exposure to the elbow, the remainder of the body not being protected. The clinical phenomena and the results of the metabolism investigations were exactly similar to those in the case just mentioned, and even more striking in some respects. These experiences should be sufficient to teach us a lesson in caution. In addition, by "reading between the lines" while reviewing the literature on leukaemia and pseudoleukaemia I have found several instances in which rather sudden death has resulted from evidently indiscreet X-ray exposures. You may be assured that there is sufficient evidence at hand to warn us not to expose to X-rays, either for therapeutic or skiagraphic or fluoroscopic purposes, patients suffering from grave diseases, especially when there are evidences of severe toxemias. In such a category I would place such conditions as pernicious anemia, pneumonia, typhoid fever, acute nephritis, pyemia, and, under certain circumstances, even leukaemia and pseudoleukaemia. Certainly the rays should not be used for experimental purposes in such cases.

It is possible to recall one instance of a short skiagraphic exposure markedly influencing metabolism. In January, 1906, Dr. Edsall referred a case of unresolved pneumonia for application to the left side of the chest, with the view of hastening, by means of the stimulation of antolysis, a resolution which had been at a standstill for two weeks, and also to study the metabolism, as had been done with several other cases. Before beginning the treatment I desired to make a skiagraph of the chest for comparison and deferred the therapeutic application until the next day. Although this skiagraphic exposure lasted but 8 seconds, the effect upon metabolism was remarkable. The output of nitrogen rose over 100 per cent. during the following 24 hours, and the chlorides increased about 60 per cent. After this, 5-minute mild exposures were given daily, and as resolution progressed the elimination gradually subsided to the normal point of the control period on the eighth day, when all abnormal physical signs had disappeared.

In concluding these remarks concerning some of the dangers attending X-ray applications, let us realize that

for our own reputations and protecteon we have the right to demand a satisfactory report from the clinician referring the patient to us, and for the same reasons applied to himself he should be careful to give one. No more than this is reqnired by the surgeon before he orders the anaesthetic administeree to his patient. Dr. Edsall has given this abvice to the clinician, and I take the liberty of putting it in proper form to be received by the X-ray specialist.

REFERENCES FOR PSEUDOLEUKAEMIA.

1. G. H. Stover: Transactions Colorado State Med. Soc,, June, 1902.
2. G. H. Stover: Denver Med. Times, April, 1904.
3. S. B. Childs: Med. News, Jan. 24, 1903.
4. J. T. Dunn: American Practitioner and News, Oct. 1, 1902.
5. F. W. Hett: Dominion Med. Monthly, August, 1902.
6. W. A. Pusey: Journal Amer. Med. Assoc., Jan. 18, 1902.
7. W. A. Pusey: Journal Amer. Med. Assoc., April 12, 1902.
8. W. A. Pusey: Chicago Med. Soc., Feb. 26, 1902.
9. O. W. Steinwand: Journal Amer. Med. Assoc., March 26, 1904.
10. E. B. Finch: Medical Record, May 14, 1904.
11. F. Lommel: Munchener Med. Woch., May 9, 1905. Vol. 52, No. 19.
12. Paul Krause: Munchener Med. Woch., Oct. 4, 1904. No. 40.
13. Paul Krause: Forschritte auf dem Gebiete der Roentgenstrahlen, Dec. 21, 1905.
14. Levy-Dorn: Deutsche Med. Woch., Dec. 8, 1904. No. 50.
15. Pusey & Caldwell: Roentgen Rays in Therapeutics and Diagnosis
16. Holding & Warren: New York Med. Jour., Nov. 11, 1905.
17. F. H. Williams: The Roentgen Rays in Med. and Surgery, 1903, page 717.
18. C. W. Allen: Radiotherapy and Phototherapy. Pages 303-304.
19. H. Hulst: Discussion, Transactions Amer. Roentgen Ray Soc., 1906, page 183.
20. C. F. Stokes: Transactions Amer. Roentgen Ray Soc., 1906, page 205.
21. J. G. Williams: Brooklyn Med. Jour., March, 1904, page 108.
22. T. L. Butler: Louisville Monthly Jour. Med. and Surgery, Dec. 1902, and May, 1903, page 467.
23. Shoemaker & Pfahler: N. Y. and Philadelphia Med. Jour., Nov. 11, 1904, page 917.
24. N. Senn: New York Med. Jour., April 18, 1903.
25. H. F. Stoll: Medical Record, May 20, 1905, page 773.
26. Rosenberger: Munchener Med. Woch., Jan. 30, 1906.
27. J. W. Hunter: Amer Jour. Med. Sciences, March, 1906.
28. H. K. Pancoast: Transactions Amer. Roentgen Ray Soc., 1906, page 171, and Archives Physiological Therapy, May, 1906.

REFERENCES FOR LEUKAEMIA.

29. K. H. Schirmer: Centralblatt furdie Grenzgebiete der Medicin und Chirurgie. Vol. 14, page 21.
30. W. A. Pusey: See No. 7.
31. N. Senn: Medical Record, Aug. 22, 1903.
32. E. J. Brown: Jour. Amer. Med. Assoc., March 26, 1904, and March 25, 1905.

33. Grosh & Stone: Jour. Amer. Med. Assoc., July 2, 1904.
34. Bryant & Crane: Medical Record, April 9, 1904.
35. C. H. Weber: Amer. Medicine, May 21, 1904.
36. G. H. Evans: Amer. Medicine, Aug. 13, 1904, and California State Jour. of Med., August, 1904.
37. W. F. Cheyney: Medical News, Nov. 5, 1904, and California Academy of Medicine, April 25, 1905.
38. A. H. Peacock: Amer. Jour. Med. Sciences, November, 1904, page 885.
39 J. T. Dunn: Amer. Practitioner and News, Louisville, July 15, 1904.
40. C. Bozzolo: Reforma Medica, Palermo and Naples, Vol. XX, No. 34, and Gazzetta degli Ospedali, Milan, xxvi No. 41.
41. E. Schenck: Muncher Med. Woch., Nov. 29 1904, LI., No. 48.
42. Cahen: Muncher Med. Woch., Nov. 29, 1904, LI., No. 48.
43. Joachim & Kurpjuweit: Deutsche Med. Woch., Dec. 1, 1904, No. 49.
44. Schleip & Hildebrandt: Munchener Med. Woch., Feb. 28, 1905; Vol. 52, No. 19.
45. W. A. Pusey: Jour. Am. Med. Assoc., May 13, 1905; also see No. 15.
46. A. W. Hewlett: Discussion, California Acad. of Med., April 25, 1905.
47. A. Herz: Weiner Klin. Woch., xviii., No. 8.
48. F. Lommel: See No. 11.
49. Ledingham & McKerron: Lancet, Jan. 14, 1905, and Feb. 10, 1906.
50. Krone: Munchener Med. Woch., May 24, 1904. No. 21.
51. Ahrens: Munchener Med. Woch., June 14, 1904. No. 24.
52. Aubertin & Beaujard: Comptes Rendus de la Societe de Biologie, June 17, 1904, page 982.
53. Guilloz and Spillman: Semaine Medicale, June 1, 1904.
54. Rodhe: Deutsche Med. Woch., Sept. 29, 1904. No. 40.
55. Fried: Munchener Med. Woch., Oct. 4, 1904. No. 40.
56. Schweinburg: Munchener Med. Woch., Oct. 18, 1904. No. 42.
57. Soetbeer: Discussion, Munchener Med. Woch, same date.
58. Paul Krause: Discussion, Munchener Med. Woch., same date.
59. Paul Krause: Forschritte auf dem Gebeite der Roentgenstrahlen, April 30, 1905.
60. Paul Krause: Zeitschrift fur Elektrotherapie und Elektrodiagnostik, December, 1905.
61. P. Priess: Zietschrift fur Klinische Medizin, 1906, Vol. LVII., No. 5-6.
62. Grawitz: Deutsche Med. Woch., Dec. 8, 1904; No. 50.
63. T. B. Eastman: Denver Med. Times, September, 1904; p. 118.
64. W. I. Bruce: Lancet, Jan. 27, 1906.
65. P. Chester: Chicago Med. Recorder, August, 1904, p. 481.
66. Holding & Warren: See No. 16.
67. G. G. Burdick: Transactions Am. Roentgen Ray Soc., 1906, page 107.
68. Smith & Capps: Transactions Am. Roentgen Ray Soc., 1906, page 165, and Jour. Am. Med. Assoc., Sept. 24 and Oct. 1, 1904.
69. A. L. Gray: Discussion, Transactions Am. Roentgen Ray Soc., 1906, page 181.
70. Dock and Warthin: Internat. Clinics, Vol. IV., 15th series.
71. C. H. Melland: British Med. Jour., July 1, 1905.
72. J. Eichberg: Ohio State Med. Jour., June 15, 1906.
73. Schultz: Munchener Med. Woch., March 28, 1905.
74. W. J. Taylor: Cincinnati Lancet Cl., May 14, 1904.

75. C. Columbo: Semaine Med., 1904, Vol. XXIV., No. 44, page 352, and Bulletin Official de la Societe Francaise D'Electrotherapic et de Radiologie, Paris, November and December, 1904.
76. Elliott: New Orleans Med. and Surg. Jour., Jan. 1, 1905.
77. E. Meyer: Berliner klin Woch., 1905, No. 2.
78. Von Raake: Berliner klin Woch., 1905, No. 2.
79. H. Grad: Jour. of Advanced Ther., January, 1904, page 30.
80. H. J. Thompson: Med. Record, March 3, 1906.
81. F. Rosenberger: Munchener Med. Woch., Jan. 30, 1906, Vol. LIII., No. 5.
82. Acuna: Archives D'Electricite Med., June 10, 1905.
83. Beclere and Beaujard: Archives D'Electricite Med., July 10, 1905
84. A. Hoffman: Forschritte auf dem Gebiete der Roentgenstrahlen, April 30, 1905.
85. W. B. Ransom: British Med. Jour., March 7, 1906.
86. Lossen and Morawitz: Deutsche Archiv fur klin. Med., 1905, No. 83, page 288.
87. O. Eisenreich: Munchener Med. Woch., Jan. 24, 1905, No. 4.
88. W. Wendel: Munchener Med. Woch., Jan. 24, 1905, No. 4.
89. Schieffer: Munchener Med. Woch., Jan. 24, 1905 No. 4.
90. H. K. Pancoast: See No. 28.

MISCELLANEOUS REFERENCES.

91. Heineke: Deutsche Zeitschrift fur Cherurgie, Vol. LXXVIII, Nos. 1 to 3.
92. Warthin: Internat. Cl., Vol. IV. 15th series.
93. Smith and Capps: See No. 68.
94. Turk: Wiener klin. Woch., Vol. XVII., No. 7.
95. Heineke: Munchener Med. Woch., 1903, No. 48.
96. Pfahler: Discussion, Transactions Am. Roentgen Ray Soc., 1906, page 183.
97. Eichberg: See No. 72.
98. M. Ascoli: Reforma Medica, Vol. XX. No. 51.
99. C. Bozzolo: Gazzetta degli Ospedali, Milan, Vol. XXVI, No. 41.
100. Pulley: Lenox Med. Soc. Report, 1903.
101. K. H. Schirmer: Centralblatt fur die Grenzgebiete, Vol. VIII, Nos. 1 to 4.
102. Renon and Tixier: Bull. Soc. Med. des Hop. de Paris, March 15, 1906.
103. Neutra: Zeitschrift fur Heilkunde, 1903, No. 11.
104. W. A. Pusey: Jour. Am. Med. Assoc. May 13, 1905.
105. S. B. Childs: Colorado Medicine, February, 1904.
106. Warthin: Trans. Am. Roentgen Ray Soc., 1907.
107. Lindner: Deut. Archiv. f. klin. Med., vol. lxxxv. Nos. 1 and 2.
108. Richardson: Annals of Surgery, November, 1905.
109. Dock: Amer. Med., December 24, 1904.
110. Churchill: Am. Jour. Med. Sci., October, 1904
111. Buchanan: Brit. Med. Jour., July 14, 1906.
112. Halber and Linser: Munch. Med. Woch., April 11, 1905.
113. Musser and Edsall: Univ. of Penna. Med. Bull., Sept., 1905.

ADDITIONAL REFERENCES NOT INCLUDED.

114. Franke: Wien. klin. Woch., vol. xviii, No. 33.
115. Rosenberger: Centralbl. f. innere Med., January, 1906.
116. H. Flesch: Jahr. f. Kinderheil., vol. lxii. No. 3.

117. H. Flesch: Deut. med. Woch., vol. xxxii. No. 16.
118. Aubertin and Beaujard: Presse Med., 1904, No. 67.
119 Barjon, Cade, and Nogier: Lyon Med., vol. ciii. p. 188.
120. Guerra: Gazz. deg. Osp., Milan, 1904, vol. xxv, p. 989-993.
121. Arneth: Munch. med Woch., vol. lii, Nos. 32-34.
122. Curschmann and Gaupp: Munch. med. Woch., vol. lii, No. 50.
123. Kleinberger and Zoepritz: Munch. med. Woch., vol. liii, No. 18.
124. Rhode: Deut. med. Woch., 1904, No. 40.
125. Stone: Deut. med. Woch., 1904, No. 31.
126. Arneth: Berl. klin. Woch., vol. xlii. No. 38.

Dr. George E. Pfahler, Philadelphia: These two papers represent a great deal of work and they are most valuable. There is nothing that we need more than just such investigations as these. They hold our enthusiasm in check and warn us of the dangers to our patients and to ourselves, especially those of us who are doing a great deal of fluoroscopic work. If these effects are produced on patients treated for leukemia or for other diseases, why should the prolonged use of the ray not affect us as radiologists. I think we would do well to take heed and not examine any case fluoroscopically, especially not merely to satisfy the curiosity of another physician. We should be masters of the situation and only choose such cases for fluoroscopic work as can not be examined satisfactorily by the plate.

The case of polycythemia to which Dr. Pancoast referred and to which I called your attention last year, Dr. Robertson and I still have under observation. I saw him once a month and gave him a treatment. I have not had careful investigations made on the effect of the X-ray on metabolism, but in a general way my patient is healthy and feels comfortable. His spleen is still large and has never been reduced more than two-thirds its original size. His red corpuscles remain about the same as they were originally, numbering about eleven million.

Referring to the changes produced by the X-rays in the kidneys, I have a patient who has a mediasteinal carcinoma that I treated three years ago, the first six months every day for about thirty minutes. Later she has had treatments only three times a week. If the changes in this patient's kidneys are as marked as those recorded by Dr. Warthin we would surely expect her to be dead before this because the kidneys were exposed indirectly to the rays all the time, for part of the time I was treating the stomach and uterus, which showed symptoms of involvement by the carcinoma.

Dr. Charles Lester Leonard, Philadelphia: This subject is one of the utmost importance and from the papers we can draw lessons of value in many respects. One point must be emphasized strongly; that is that the cases reported are reported as being pathologic conditions treated by the X-rays. There is today in the profession a widespread misconception of these reports of cases. Doctors are saying that it is dangerous to have a patient exposed to the X-ray no matter what the trouble, even to have a skiagraph made. I heard it said at the American Medical Association that it is dangerous to have a patient's eyes examined for the purpose of locating a foreign body because of the changes that might take place.

We must draw a distinct line between cases that are pathologic and those that are normal, the latter being referred only

for X-ray examination. If it is coming to the point where it is dangerous to examine a patient with the X-ray for stone in the kidney, I want to know why. We have records of thousands of cases at the present time that have been examined with the X-ray for disease of the kidney, and among these there is not one case in which injury has been done to the kidney. I have examined over 340 cases for stone and in not one of these cases was the condition of the urine changed or made pathological.

There are many other lessons that can be drawn from these two very excellent papers, which have advanced our knowledge very much. I have lately called attention to the absence of insight into the value of the X-ray treatment which has been shown by surgeons. Cases were reported recently in Philadelphia, and every surgeon present at the meeting confirmed what the surgeon who read the paper stated—that he found the lymphatic channels totally destroyed where treatment had been given for a tubercular adenitis of the neck, and that it was difficult on that account to remove the glands. In another case, one of carcinoma of the breast, the lymph channels were solid cords, making it difficult to remove the breast. I cannot understand why it was necessary to remove that breast if the lymph channels were destroyed. If we can succeed in destroying the lymph channels then we have complete control of the disease. Nothing can show better the value of the ante-operative treatment than destruction of ment that the lymph tissues are the first to be destroyed), because if we can destroy the lymph channels we prevent metastasis. We convert a general disease into a local one and we can then control it.

The trouble is that in the postoperative cases the lymph channels are open and there is a hastening of the metastatic process and the disease recurs in spite of the X-ray treatment. In cases of malignant disease the best thing to do is to treat with the X-ray before operation, destroying the lymphatics, then remove the mass of the disease and destroy any remaining vestiges of the disease with the X-ray afterward.

Dr. S. Mason McCollin, Philadelphia: I can bear out what Dr. Leonard says. The case of carcinoma of the breast to which he referred I was interested in myself. The family history was very bad. The mother, father, sister and an aunt had all been operated on for carcinoma. The patient received X-ray treatments from me for a considerable time and afterward she was operated on. The tumor was examined microscopically and there was no reason whatever for operation. Four knives were dulled during the operation. The lymphatics were destroyed entirely and I can see no reason whatever for taking off that breast because there was no longer any danger of metastasis.

Dr. Charles F. Bowen, Columbus, Ohio: I recall a very unfortunate instance, that of a boy, five years of age, who had a
a very severe headache. At nine o'clock in the morning of the
ment at nine o'clock in the morning, and that afternoon he had
lymphatic leukemia of two months' duration. I gave him a treat-
second day I gave him another treatment of four or five minutes'

duration. That afternoon he had a convulsion and during the night he died. I believe death resulted from a toxemia.

Dr. William H. Dieffenbach, New York City: In the past three or four years I have treated three cases of Hodgkins' disease and one case of splenomyelogenous leukemia. I was particularly interested in the complete report which Dr. Pancoast gave us on the action of the X-ray on metabolism and on the lymph tissues. It corroborates what I have observed in my work.

The first case I treated occurred shortly after Dr. Senn reported his success with the X-ray in the treatment of leukemia. My case was one of absolute Hodgkins' disease as was shown by the blood examination. My patient was treated for ten months, three times weekly, and is symptomatically cured. In the second case after the first treatment the glands diminished so rapidly that I suspended treatment and sent the patient home. Two days afterward his physician wrote me that he had developed a temperature of 106 degrees Fahrenheit. The man died within two days. That seemed to me rather a severe blow to our expectations of an apparent cure of the inflammatory enlargement, and that induced me to change my treatments. Instead of giving ten minute treatments three times weekly, I reduced the time to two and three minutes tri-weekly.

Of the three cases of Hodgkins' disease two died; the other was cured symptomatically. I feel that by having reduced the dosage of the X-ray I eliminated the danger of toxemia, which was referred to in the papers. Mild radiation is sufficient to produce a change in the lymphoid tissues and to destroy the lymphoid cells.

My case of splenomyelogenous leukemia had over 52 per cent. of myelocytes. That patient has been under observation for two and a half years. The myelocytes have been reduced to twenty per cent., and the patient is in apparent good health. We have undoubtedly prolonged her life, so that in the case of a disease which formerly was considered intractable we find in the X-rays a measure that will help us to keep these patients in fairly good condition. The patient was rayed for one, two or three minutes at one sitting. I attribute her long life to the mild treatments which caused less toxemia. The spleen extended over an inch and a half to the right of the umbilicus. At present writing the spleen has been reduced to about twice its normal size and the myelocytes are down to 100 per cent. This patient was treated by alternately raying the spleen and the long bones (femur, tibia, etc.) twice a week, radiations from a hard tube being given for from three to five minutes at each sitting.

Dr. Wells, St. Louis, Mo.: I want to show you a slide representing a man fifty years of age, otherwise in good health, who had a carcinoma of the right side of the brow. After an exposure of fifteen minutes' duration he became drowsy. In half an hour he went into a state of semi-coma, then coma, death ensuing fifteen hours afterward. I made inquiry among the members of his family in order to ascertain whether or not he had had a nephritis or other constitutional disease. From his physician I learned that the man had been a nephritic at one time and had suffered from an acute uremia, thus, according to the Pancoast theory, explaining the suddenness of his death.

Dr. George C. Johnston, Pittsburg, Pa.: I am very glad, indeed, that Dr. Warthin has given us a description of the actual pathologic changes that take place in the kidney after that organ

has been exposed to the X-ray. It has been a matter of common knowledge among roentgenologists that prolonged radiation is sometimes followed by undesirable effects. In the case of every patient subjected to X-radiation for therapeutic effect the first thing to decide on is, what is the capacity of the kidneys of the patient, because as soon as you expose a patient to X-radiation you throw an overload on the kidneys. Therefore you ought to determine the competency of the kidney to carry a normal load, and then figure out how much of an overload they can carry or you will get into trouble.

Usually in the case of a patient under twenty years of age the competency of the kidney can be assumed unless there is a testing for albumen and sugar, will give you a good idea of the competency of the kidneys. Then figure the amount of overload that you dare not exceed. But it is necessary to have a careful examination made of the urine from time to time so as to keep out of trouble.

About three years ago I had some very unfortunate experiences in that direction, none of which resulted fatally, however. In one case, one of acute dermatitis, a complete cast of the hand was thrown off with practical suppression of the urine. The urine was heavily loaded with albumen. The patient was being rayed for a small lesion of the lower lip, but it is not the size of the lesion that counts; it is the rapidity with which the exposed tissue is broken down.

Dr. Kennon Dunham, Cincinnati, Ohio: There is nothing to which we should pay more attention than the necessity of doing careful work. For two years I tried to go into details, stating my belief that we could keep out of a great deal of trouble by careful examination of the urine. We should not limit our examination to the determination of the presence of these abnormal products in the urine, but we should also make a careful quantitative examination. The urine should be collected during a forty-eight hour starvation. We must be very careful, however, not to get scared. It is a very easy matter to frighten everybody into thinking that to come in sight of an X-ray tube is dangerous.

The vast majority of patients who come to me have almost no change in the urine; no evidence of any toxemia, and yet once in a while it is well to postpone the treatment for a while and go slow. The real danger lies in the fact of being over-sure. The cases that have gone wrong have been cases in which we least expected such a result. Therefore I plead for a systematic examination of the urine, especially for the quantitative examination of the urea.

Dr. Pancoast, closing the discussion: It was not my intention to scare anyone with regard to the danger of X-ray applications in general, but simply to call attention to the necessity of care in using the rays for any purpose in certain diseased conditions. We should not experiment with such cases even though X-ray treatment may be indicated. I hope that no one will be unnecessarily alarmed by anything mentioned in my paper.

PRESENT STATUS OF ROENTGEN THERAPY.

By G. H. Stover, M. D., Denver, Colo.

Undoubtedly the greatest discovery of recent times was the discovery of the Roentgen ray; while there have been many epoch-making discoveries in commercial fields, some of which have greatly lessened labor and increased production of things important to humanity, none of the great commercial inventions have led to such important results in producing absolute benefactions as has the finding of the Roentgen ray; even comparing it with its immediate great predecessor, the anti-toxin of diphtheria, one is tempted to credit the Roentgen ray with having the larger field of usefulness.

With regard to the therapeutic use of the Roentgen ray, one is somewhat astonished to note that so few hopes, later found to be impossible of realization, were indulged in by the early workers in the field of this marvelous discovery; it is remarkable that so many of the early beliefs as to its usefulness have been proven by careful scientific study. The reason for this is not hard to find; the men who did the first therapeutic work with the Roentgen ray were trained scientific students whose habits of mind were careful and conservative; they were not carried away by the marvel of the thing; to them it was simply another form of manifestation of energy, its nature to be learned and its functions to be formulated.

These investigations have given us a sure scientific foundation upon which to base our therapeutic use of the ray, and from which we may predicate the action to be derived from it in a constantly increasing list of human ailments.

In the first place, let us briefly consider what is now known of the physiological and pathological action of the Roentgen ray.

Tissue cells exposed to the action of the Roentgen ray undergo degeneration. If the doses have been massive, the process is much like inflammation; stasis occurs in the small vessels, leucocytes and lymph escape into the tissues and if the doses have been extreme a condition of gangrene is produced. If the doses have been moderate the changes are much more gradual, resulting in a slow atrophy. Much of the destroyed tissue is replaced by connective tissue. There is a difference in the susceptibility of different tissues, some being more quickly affected than others. Epithelial cells suffer earlier than others; lymphoid tissues are rather readily affected. Leucocytes are very susceptible; the intima of arterioles is somewhat resistant,

changes in the blood vessels taking place late in the process. Diseased or abnormal tissues have less ability to resist the destructive action of the rays than have healthy ones, and this is the whole rationale of Roentgen therapy. The therapeutic action of the Roentgen ray can be summed up in the one statement that it produces a degeneration of tissues, the unhealthy and abnormal tissues being the first to succumb.

In considering the present status of Roentgen therapy in specific instances of disease, we must first follow the example of our continental confreres, and make a distinction between rodent ulcer and cutaneous epithelioma. The Roentgen ray is practically a specific for rodent ulcer; the same cannot be said of cutaneous epithelioma, though many such epitheliomata have been cured by the ray, and many more will be cured by it as time goes on. Epitheliomata of the lip and of the eyelid are often troublesome to the Roentgenologist and many of the attempts to cure them by the use of the Roentgen ray will be unsuccessful. It would seem that carcinomata of mucous membranes are more resistant to the ray than are those of the skin. I have, however, under observation, a patient whom I treated for carcinoma of the tip of the tongue, who has had no recurrence in the fourteen months that have elapsed. The diagnosis was confirmed by a microscopic examination of a small piece of the growth.

Carcinoma of the internal organs is not suitable for Roentgen therapy as a primary measure in most cases; this is probably due to the fact that the disease has made heavy inroads before it is discovered. After operation, these cases should have Roentgen therapy. As to carcinoma of the breast I do not feel like making the positive statement that the Roentgen ray is the proper treatment; I have usually felt that I could not afford to oppose surgical treatment, yet I have indubitable evidence of the efficacy of the Roentgen ray here. The ray ought always to be applied after surgery in this disease, and just as certainly should it be used when a recurrence takes place after operation. Why, then, should it not be used as a primary measure? At the present time I feel that I must, when called upon to speak of the advisability of Roentgen therapy for a patient who has cancer of the breast, advise her very positively that a thorough operation is demanded; if she absolutely refuses this (and in my own heart I do not blame her much if she does refuse, in many of the instances that I see) then, and not until then, do I say that I will treat her. I take this position because, in spite of the

many failures of surgery to cure these cases there are very many that have been cured, and Roentgen therapy has not as yet a sufficiently great number of authentic cures in this disease to justify me in placing it before surgery as the best remedial measure. I do, however, look forward to the time when I shall be able, in cases not too far advanced, to believe and say that Roentgen therapy is proper. Certain instances of sarcoma are undoubtedly apparently cured by Roentgen therapy. It would seem that benefit is derived from the administration of Coley's toxin also.

In tuberculosis of the skin. as lupus vulgaris and its varieties. Roentgen therapy is the remedy par excellence. In the Roentgen therapy of tubercular glands, my results have been extremely satisfactory and other operators will make the same statement. I think surgery is a secondary consideration in this disease. As to bone tuberculosis, my experiense is quite limited; few cases of this kind come to me for Roentgen therapy, and quite properly; the Roentgen ray must be used in the diagnosis of these cases, but surgical treatment is demanded; in one patient where surgical intervention did not succeed, the ray did so; in another, a tuberculosis of the sternum. both the surgeon and I failed to do any good. I have had but few cases of joint tuberculosis under Roentgen therapy. but have had good results, the disease being located in the smaller joints.

Personally, I have had too little experience in the treatment of pulmonary tuberculosis with the Roentgen ray to make a statement as to its having any efficacy; others have reported good results, but it will take a long series of reports to place Roentgen therapy in the list of availables.

Recent literature has said a good deal of the benefit to be derived from Roentgen therapy in leukaemia, and undoubtedly a marked change has been produced in many cases, but it has seemed to me that the benefit has been only temporary; of course. even that is desirable when no more can be done; it should be remembered that temporary improvement often occurs spontaneously in this disease.

The report a short time ago by Anders of definite benefit in some cases of arthritis deformans opens a field of usefulness for Roentgen therapy in what has always previously been a hopeless disease.

I do not see of late many reports of the treatment of Hodgkins' disease by the Roentgen ray; formerly I had a number of these cases on hand, with beneficial results, but it has been a long time since I have seen a patient with this disease; possibly I have cured all there was in my part of the country, and the men in other localities have done

the same.

Not much use of the Roentgen ray has been made in the treatment of syphilis. It is rational to believe, in view of the action of this form of energy upon this form of tissues that it should be useful, particularly in specific neoplasmata, thickenings, etc.

In the field of dermatology we have much good work being done by the Roentgen ray in the cure of stubborn diseases. The remarkable results in acne alone make Roentgen therapy worth while; beside acne, though, are many other skin diseases where the usefulness of the Roentgen ray stands out prominently, among these being hypertrichosis, hyperidrosis, psoriasis, lupus erythematosus, ringworm, favus, sycosis, folliculitis, barbae, mycosis, keloid, chronic, eczema, cornu cutaneum, alopecia, seborrhoea, rosacea, and some time ago a report was made concerning some cases of leprosy which had received benefit from Roentgen therapy.

The use of the Roentgen ray for exophthalmic goitre has been attended with results pointing to usefulness. It has been used for prostatic hypertrophy with mitigation of the symptoms; in my own hands I have been so well satisfied with the effect of the Morton wave current in suitable cases that I have not used the Roentgen ray in these cases for some time.

The Roentgen ray ought to be used always after operation for malignant disease, for the reason that it is never certain that all of the affected tissue has been removed and there is good reason to believe in the ability of the Roentgen ray to sterilize the surrounding area. The great difficulty about post-operative Roentgen therapy is in deciding when the exposures ought to stop. We have at the present time no knowledge as to what constitutes a protective dose. I like to begin exposures as soon as possible after operation and to continue them for two months; then give an interval of a month, repeat the exposures during another month, give two months' interval without treatment, and then treat during a month; after that, it would be well if a month's treatment could be given every six months to one year for a time. Few patients have enough perseverance to stick to the treatment for so long a period.

There are a good many conditions in which the Roentgen ray is not properly applicable. I do not consider it of much use so far as a cure is concerned in carcinoma of the rectum, of the uterus or the liver or stomach; the disease is usually so far advanced when discovered that an

operation must be done to get rid of as much of the disease as possible; then Roentgen therapy may be useful as prophylactic. I do not believe in Roentgen therapy in cancer of the lip when there is involvement of neighboring glands, except as a prophylactic measure after surgical treatment. Whenever an operation for sarcoma offers a reasonable hope of life to the patient, the operation should be performed. Melanotic sarcoma has been totally beyond any aid from Roentgen therapy in my hands. I have failed to benefit every example of simple goitre to which I have applied Roentgen therapy; others have reported better success in a few instances.

Some symptomatic cures of fibroids of the uterus have been reported, and the idea of Roentgen therapy seems to me to be rational here; before the use of the Roentgen ray was suggested in this disease I used the continuous current, and have done so since that time. It has not happened that there has been referred to me a fibroid in which I cared to risk destroying the function of the ovaries as might occur in the use of the Roentgen ray in this locality.

The particular type of apparatus used to excite the Crookes tube is not important; it must be sufficiently powerful to produce a good quantity of rays of such a nature that they will reach the part which it is desired to affect; the induction coil takes up less space than the static machine and gives a larger output of rays. With the induction coil, if direct current is available, either mechanical, Caldwell or Wehnelt interrupter may be used; where only alternating current supply is at hand, either the Wehnelt interrupter, or one of the valve type using alkaline solutions will be found most useful.

A good tube capable of vacuum regulation, is essential; it is not worth while to buy cheap tubes; they are poorly constructed and do not last. I usually use the tubes which I buy for skiagraphic work as therapeutic tubes until they are seasoned, using them at first for superficial work, then for a time in the treatment of cases where the disease is more deeply seated, and soon they will do for skiagraph making. The operator who has a number of machines may shift his patient from one machine to another according to the condition of the tube, thus avoiding the necessity of frequently changing the vacuum in a single tube, which is not a good thing; it is an insult to a first class skiagraph tube to reduce its vacuum in order to get it low enough for a skin application.

Every tube used for therapeutic purposes ought to be provided with a screen which will limit the rays to the

near neighborhood of the site of disease; it is not necessary to ray the patient's whole body, and it is certainly not a good thing for the operator or his assistant to be compelled to work in rooms where the whole space is a Roentgen ray field.

I do not believe in masssive doses of the Roentgen ray; the amount of action cannot be safely or accurately controlled when massive doses are given; as a routine, the best method for a majority of cases consists in giving the treatments three times a week; this enables one to detect the appearance of signs of full action, and to modify the length or frequency of exposure before any damage has been done.

I have not as yet been able to make up my mind as to the usefulness of ray filters, though I have been, since Doctor Pfahler's suggestion, using a sole leather filter in all cases in which I wish to expend the Roentgen energy beneath the skin without affecting that structure.

I do not believe that we have as yet found a measure of Roentgen energy. Many devices have been offered, but all of them are subject to much error, either from the personal equation of the operation, or on account of inherent physical properties in the makeup of the apparatus itself which lead to variations in their readings; some of the sensitive substances used are subject to change from other causes than Roentgen ray action; the result with others will vary with atmospheric conditions of moisture or electricity; it seems that experience in the use of the rays will enable the expert to judge as to the effect he is going to produce when he knows the type of machine he is using, the amount of primary current supplied, the kind of interrupter, and the condition of the tube. Of course, a Roentgenmeter which is free from the defects above mentioned is greatly to be desired; it would be a great satisfaction to the expert operator and would make Roentgen therapy much safer in the hands of the general practitioner who has only infrequent use for it.

JULY, 1907

AMERICAN QUARTERLY OF ROENTGENOLOGY

PUBLISHED BY THE AMERICAN ROENTGEN RAY SOCIETY

Volume I. No. 4

Next Annual Meeting
Cincinnati

October 2nd, 3rd
and 4th, 1907.

ONE DOLLAR
PER COPY

THREE DOLLARS
PER YEAR

CINCINNATI MEETING NUMBER

American Quarterly of Roentgenology.

Published by the American Roentgen Ray Society.

PRESTON M. HICKEY, M. D., Editor,
32 West Adams St., Detroit, Mich.

GEORGE C. JOHNSTON, M. D., Managing Editor,
611 Fulton Building, Pittsburg, Pa.

H. W. DACHTELER, Advertising Manager,
237 Michegan St., Toledo, O.

COLLABORATORS.

Business Office, 611 Fulton Building, Pittsburg, Pa.

American Quarterly of Roentgenology.

Published by The American Roentgen Ray Society.

CONTENTS

APPLICATION FOR MEMBERSHIP
IN
THE AMERICAN ROENTGEN RAY SOCIETY

I,.., hereby make application for membership in

THE AMERICAN ROENTGEN RAY SOCIETY

I am ....of age. I was born at .... and now reside at ....

.... I am a graduate of ....

from which I hold the following degrees; ....

....

My occupation at present is that of ....

I am now a member in good standing of the following learned societies:

....

....

Signature..

We, members in good standing of THE AMERICAN ROENTGEN RAY SOCIETY, consider

....to be well qualified to become a good and useful member of the Society, and recommend that...be received.

Signature..

Signature..

The Executive Committee hereby approves the above application.

Signature..

Signature..

Signature..

ANNOUNCEMENT

The next meeting of the American Roentgen Ray Society will be held in Cincinnati, October 2nd, 3rd, and 4th, at the Grand Hotel.

The Grand Hotel is located on the south-west corner of Fourth Street and Central Avenue.

Arrangements have been made whereby the Convention Hall, the Exhibit and board and rooms for the members are furnished under one spacious roof. There will be ample accommodation for all upon either the European or the American plan. The rates for the latter will be three dollars a day up.

This is a very large and well appointed hostelry, which is able and anxious to afford the Convention every accommodation.

Lantern slides are expected to be an important feature and every arrangement for this has been made. The lantern is of the best and the hall can be perfectly darkened.

Any suggestions from members which are intended to add to the success of the Convention, or to the comfort or pleasure of those attending can be sent to

Dr. Kennon Dunham,
2503 Auburn Ave.,
Cincinnati, Ohio.

PRELIMINARY PROGRAM OF THE CINCINNATI MEETING.

SENILITY AND ITS ROENTGENOLOGICAL ASPECTS.

Dr. Percy Brown, Boston, Mass.

SPECIFIC IMMUNITY AND X-RAY THERAPEUTICS.

Dr. A. W. Crane, Kalamazoo, Mich.

SUPERIOR RESULTS IN FRACTURES OBTAINED BY RADIOGRAPHIC EXAMINATIONS.

Dr. Arthur Holding, Albany, N. Y.

THE EARLY RADIOGRAPHIC DIAGNOSIS OF PULMONARY TUBERCULOSIS.

Dr. Lewis Gregory Cole, New York.

SOME EXPERIMENTS WITH X-RAY TUBES.

V. J. Willey, Ann Arbor, Mich.

STEREOSCOPIC RADIOGRAPHY.

Dr. Max Reichmann, Chicago.

REPORT OF CANCER CASES TREATED WITH THE X-RAY AND COMMENTS THEREON.

Dr. Ennion G. Williams, Richmond, Va.

GOITRE.

Dr. George C. Johnston, Pittsburg, Pa.

A ROENTGENOLOGICAL CONTRIBUTION TO THE STUDY OF THE CONSTIPATING EFFECTS OF MORPHINE UPON HUMAN BEINGS.

Dr. Henry Hulst, Grand Rapids, Mich.

PROTECTION OF THE OPERATOR.

Dr. Chas. L. Leonard, Philadelphia.

PROTECTION OF THE PATIENT.

Dr. Russell H. Boggs, Pittsburg, Pa.

THE POST-OPERATIVE TREATMENT OF CARCINOMA.

Dr. Walter C. Hill, Cleveland, Ohio.

THE TREATMENT OF SARCOMA.

Dr. G. E. Pfahler, Philadelphia, Pa.

THE HISTOGENESIS AND DIAGNOSIS OF BENIGN BONE CYSTS.

Dr. George P. Muller, Philadelphia, Pa.

PRELIMINARY REPORT UPON A MORE RATIONAL METHOD OF TREATING LEUKEMIA BY THE X-RAY.

Dr. Henry K. Pancoast, Philadelphia, Pa.

A FURTHER STUDY OF THE ACTION OF X-RAYS IN LEUKEMIA.

Dr. Joseph F. Smith, Chicago, Ill.

LANTERN SLIDE DEMONSTRATION OF SOME TYPES OF ARTHRITIS.

Dr. Albert H. Freiberg, Cincinnati, Ohio.

MARKING AND STORING NEGATIVES.

Dr. W. S. Newcomet, Philadelphia.

AN X-RAY UNIT DEMONSTRATED BY A STANDARDIZED METER.

Samuel Allen, Ph. D., Cincinnati, Ohio.

PRESIDENT'S ADDRESS.

P. M. Hickey, M. D., Detroit, Mich.

EDITORIAL DEPARTMENT

In a conversation which the writer had a few days ago with a gentleman who took up X-ray work a few months after its introduction, we were struck with the slowness with which the profession took hold of the new discovery. Although the gentleman just referred to installed a very efficient outfit for those days, yet he did not have a call once a month for its use, although located in a large city. Physicians refused to believe that the findings upon the plate were accurate enough to base surgical proceedures upon. The writer remembers showing a print of a stone in the kidney some years ago to a prominent surgeon who at once expressed his contempt for such a method of diagnosis; two years later the same surgeon read a paper before his state society in which he advocated the use of the Roentgen ray as the most reliable proceedure in determining the presence or absence of renal calculi. All of which goes to show that the profession must be instructed in the uses of the ray and have its efficiency demonstrated. The obligation of this teaching rests upon those whose special line of work and experience makes them familiar with these technical findings. Writing papers to be read before local societies, the sending out of reprints which are well illustrated all serve to disseminate the knowledge of the usefulness of Roentgen proceedures, both diagnostic and therapeutic.

It is hardly part of the duties of the editor to call attention to the necessity of prompt payment of dues. A moment's reflection is sufficient to show that the work of a large society cannot be carried on without the substantial co-operation of all its members.

A discussion which is accompanied by lantern slides is usually intelligible without long explanations as well as being much more forceful.

The college catalogues which have come to hand show that many of the leading colleges in the country are recognizing the importance of Roentgenology as shown by the appointment of professors of this particular department. With this subject taught to the students who are taking

their medical work, the future recognition of the importance of Roentgen diagnosis and therapy is assured. The indifference and ignorance of the older medical men is to be replaced with the proper training and education of the future medical generation.

We are glad to note the arrival of a special exhibit prepared for our annual meeting by Dr. Alban Koehler, of Weisbaden. This noted Roentgenologist, with whose published works our readers are doubtless familiar, has sent a very interesting collection of prints illustrating many of the common and rare pathological conditions of the hip. In addition he has sent a cinetographic film which illustrates the physiology of normal respiration. The description of the process by which this film was obtained will be given when the moving pictures of respiration are thrown upon the screen. Arrangements have been made by Dr. Lange, of the local committee of arrangements, to have the film properly demonstrated at our annual meeting.

The approaching meeting at Cincinnati on October 2, 3 and 4, promises to be largely attended, and the various committees in charge of the different features of entertainment have arranged a comprehensive and instructive program. The benefits which will accrue to those who will attend these sessions will be hard to calculate. Roentgenology is a science which is young, its literature as yet comparatively scant, and its developments so rapid that the average worker finds it greatly to his advantage to be brought in contact with his co-workers. Much of the good to be derived from attending will come not only from the hearing of formal papers and discussions, but also from the opportunities of free and informal talks with fellow workers.

The favorable comments which have been bestowed on the Quarterly would seem to warrant its continuation. The arguments which favored its establishment, namely, a means by which the members of the society could be kept in touch with the proceedings of the society, still hold true. The policy of its future management, the problems of its financial foundation are matters for the members to decide. From many standpoints, the editorship should be distinct from the other offices, from the standpoint of convenience

the business managership should be combined with the office of treasurer. As the Journal becomes better known, many of the present problems of finance will be more easily solved.

If the plans of the print committee are fulfilled and their expectations realized, the members will soon have the opportunity of studying a large collection of instructive negatives. It would indeed be a work of which the members of this society might be proud if a proper selection of these contributed could be made and suitable reproductions provided which could be issued perhaps in the form of a supplement to the Quarterly. In this way an atlas of sarcomata of bone, of renal calculi and of tuberculosis of the joints could be gotten together which would be of the greatest value.

NEW METHOD OF USING ROENTGEN RAYS.

By A. Howard Pirie, London, Eng.

Pirie took 1 c.c pipette about a foot long, divided into 100 divisions, melted one end and blew a bulb on it about the size of a pigeon's egg. Two platinum wires were let through the glass of the bulb and sealed into the glass, so that their free ends project into the interior of the bulb without touching each other. The bulb was then filled with tap water. A drop of water is placed in the lumen of the tube opposite the divisions. This drop adheres to the walls of the tube by capillary attraction. This Pirie calls the indicator drop.

The instrument is then placed in series with the X-ray tube, and the current which flows through the X-ray tube flows through the water in the bulb between the platinum wires. This flow of current decomposes the water in the bulb and bubbles of gas are seen to rise from the platinum wire. These bubbles collect in the lumen of the tube and so force the indicator drop to rise.

When a child's scalp is placed at 15 c. c. from the source of the X-rays while this instrument is in series with the X-ray tube, and the indicator drop has risen 11½ divisions, then the scalp has received a standard dose of X-rays and epilation will follow. Pirie has produced epilation in 3 minutes and in 20 minutes trusting simply to the quantimeter, which measures total quantity that has passed in a given time.

AMERICAN
Quarterly of Roentgenology

Volume I | JULY 1907 | Number 4

THE DIFFERENTIAL DIAGNOSIS OF THE CHRONIC NON-TUBERCULAR JOINT DISEASES BY MEANS OF THE ROENTGEN RAY.

Robert B. Osgood, M. D., Boston, Mass.

It is with many apologies that I intrude a more or less clinical paper on this Congress of Technical Roentgen Ray workers. I believe, however, that no matter how great the progress in Technique may be, we must always consider Roentgen work the servant of clinical medicine, and must ever hold the accurate interpretation of our plates of as great importance as the perfection of the process.

We hear much of Tuberculosis and of its prevalence; we are told that Pneumonia almost heads the list of diseases in the extent of its inroads. And yet we venture the opinion that there are as many patients who are afflicted with "Rheumatism" as there are who suffer from the Great White Plague, or succumb to Pneumonia.

The word "Rheumatism," as Painter has said, is often a cloak behind which much diagnostic incapacity hides itself.

It satisfies the patients, for the multiplicity of its manifestations is proverbial, and the physician feels that, having called something which he does not understand by an accepted medical name, he has a perfect right to begin the administration of the salycilates which are questionably Specific in one form.

All careful observers are agreed that the word "Chronic Rheumatism" is an almost useless term, and, if used at all, should be confined to the description of a

great class of diseases of chronic nature affecting the joints, in the same way in which we speak of the Exanthemata or the Thoracic diseases.

Types of this great class of joint trouble can be separated as easily as Scarlet Fever can be differentiated from Diphtheria, and, except for the one common factor of joint affection, are quite as distinct diseases.

This paper will not concern itself at all with the treatment of these conditions. Its aim is to describe gross clinical differences, to discuss briefly a classification, which although by no means perfect, offers an opportunity for intelligent study, and to point out the value of the Roentgen Ray as a method of diagnosis.

Most of the lantern slides are from the collection of Dr. Joel E. Goldthwait, who was among the earliest in this country to point out the clinical separateness of the types. The writer and his assistants have taken the Roentgenographs, and had the opportunity to see the clinical as well as the Roentgen Ray course of the disease.

Lantern slides are at best imperfect illustrative media, and many of the original plates have little merit as examples of the skiagrapher's art, but if they make clear the suggested method of classification, and serve to demonstrate the essentials in the interpretation of plates, they will, perhaps, have justified their showing.

Opportunity for clinical observation is usually the forerunner of better understanding of obscure conditions. This was true of the cases of chronic non-tuberbercular joint affections. It is the prevalence of these chronic rheumatic lesions, their unsatisfactory treatment, and the imperfect comprehension of their nature and pathology, that has led a group of orthopedic men to more carefully study these joint deformities, although they should be, perhaps, more fittingly the problems of internal medicine.

Adult Orthopedics is an infant specialty, but its creepings will soon become, we believe, the walk of a full-grown being. It has not progressed far, but necessity has developed it, and the profession generally welcomes it, glad to see a confused mass of cases differentiate itelf into comprehensible and partly classified groups.

Practically all observers of chronic joint conditions early become aware of the fact that "Arthritis Deformans" includes many distinct types. Schüller, Pribram, Bannatyne, Still describe one or more types which

they consider separate conditions, or different manifestations of the same disease. Whether these types are absolutely distinct, and whether the etiologic factors in the different types are also separate, matters little to us as Roentgen Ray workers. If a type of chronic Rheumatism has a certain consistent clinical picture which remains constant throughout its course, if, at the same time, its pathology, studied from fresh specimens, is also constant in the essentials, and if, most important to us, the Rontgen plates show constantly the same bone processes, the type for us may be classified as a separate disease.

That we can thus separate Chronic Rheumatism into more or less intelligible classes, we hope to be able to show you. As has been intimated above, the classification which is proposed was first suggested by clinical observation.

Villous Arthritis.

There were certain joints frequently seen in which the function was impaired and pain was present, but associated with which there was practically none of the constitutional disturbance which we associate with Arthritis Deformans. Trauma, joint strain from faulty weight bearing, etc., were etiologic factors, and the lesion from palpitation and subsequent joint section was found to be a proliferation of the synovia, or the intrusion of the periarticular fat, producing a villous arthritis or the so-called Lipomata Arbosescens. That these cases often existed independently of any other more subtle joint change was soon evident.

The mistake must not be made of thinking of this condition of villous arthritis as a separate entity, for its etiology is too varied, and its association with many or all of the more distinct pathologic types is common. It needs, nevertheless, a separate mention since it may exist independently of the other types.

Atrophic Arthritis.

There were some cases, however, which soon grouped themselves together more consistently. The typical picture was a poorly nourished individual, more commonly of the feminine sex, who, in early adult life, very frequently after mental or physical strain, began slowly to develop polyarticular swelling and pain. The hands and the carpal, metacarpal-phalangeal and mid-phalangeal joints of these were usually first affected. The disease

had remissions and exacerbations, but ran a progressive course, now slowly, now rapidly.

These were the cases of subacute Rheumatoid Arthritis of Bannatyne.

The essential feature, as the disease declared itself, both clinically, pathologically and in the Roentgen plates was a loss of cartilage substance, erosions of cartilage and bone, and a diminution of lime salts, in other words, an atrophy; hence because of its essential feature, it was called Atrophic Arthritis.

Hypertrophic Arithritis.

Of nearly equal frequency, another class separated itself. The individuals were as a rule well nourished, heathful appearing types, more commonly in the last three decades of life, and having led lives of considerable activity.

The condition was more insidious in its onsets, and more gradual in its progression, though not without exacerbation.

The lesion was, perhaps as often monarticular in symtoms as polyarticular, though careful examination usually revealed a similar condition in other joints perhaps symptomless. The Herberdens nodes of the terminal phalanges represent the most obvious lesions of this class.

These were the cases of "Chronic Rheumatoid Arthritis of Bannatyne, The Osteoarthritis of many writers, and The Osteoarthritis Deformans of Pribram.

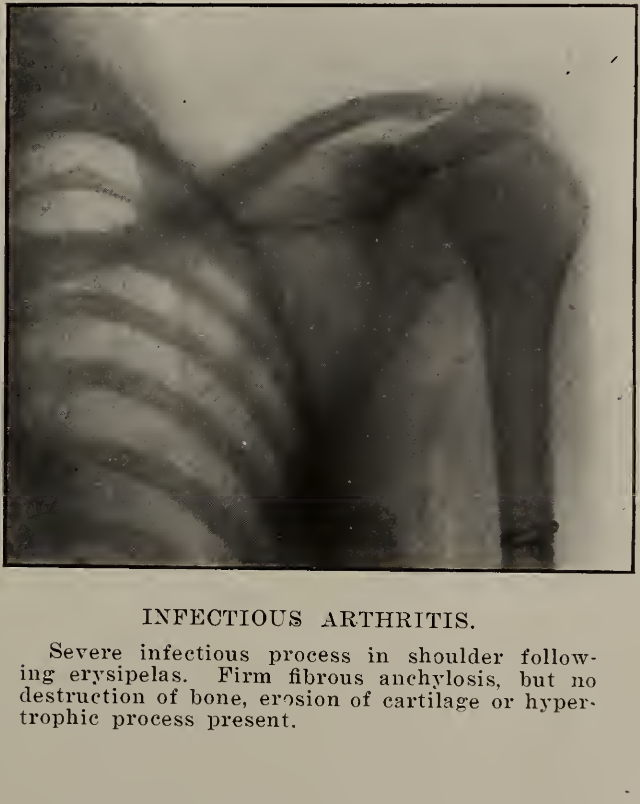
The essential feature here, both clinically Pathologically and in the Roentgen plate was thickening of cartilage, overgrowth of bone, and an increase in the deposition of lime salts. Hence, from its essential feature, it was called Hypertrophic Arthritis.

Infectious Arthritis.

For a considerable period these two classes alone were studied, but as soon as a careful analysis of each case came to be made, and as soon as the general medical men began to refer more of the chronic joints for an orthopedic opinion, cases were met which conformed to neither of these types.

The joints following Gonorrhoeic infection had been, for a long time, familiar; the development of certain cases of acute articular Rheumatism, into Chronic Polyarticular Rheumatism, was a well-known fact, and the joint sequellae of Scarlet Fever, Typhoid, Pneu-

HYPERTROPHIC ARTHRITIS.
Spicule seen on patella, on femur and head of tibia.



INFECTIOUS ARTHRITIS.

Severe infectious process in shoulder following erysipelas. Firm fibrous anchylosis, but no destruction of bone, erosion of cartilage or hypertrophic process present.

monia, Grippe, Tonsillitis, and Dysentery were realized to be far more common than the literature would lead one to suppose.

When these joint inflammations went on to pus formation, and actual sepsis ensued, articular changes of all sorts occurred. In the vast majority of cases, however, no such acute processes ensued, and the striking characteristic of these chronic joints aside from their periarticular and articular swelling, the general constitutional disturbance, the frequent glandular involvement and the atrophy of disuse was the entire absence of either the atrophy or hypertrophy of the articular surfaces proper, which changes formed the basis of the distinction between the two previous classes. In this great group came most of the Chronic Rheumatism of literature, Still's disease, and the frequent sporadic cases of chronic joint disease in which special organisms have been found.

For lack of a better name, these cases were called Infectious Arthritis, including under that head not only the direct joint infections, but also the joint disturbances resulting from some vitiation of the blood stream due to the elaboration of toxines, from some focus of infection in the body, as, for example, the tonsils, or from some disturbance of metabolism, glandular or otherwise.

The name Infectious Arthritis has an etiologic significance, while atrophic and hypertrophic arthritis are descriptive of the Pathologic findings. As we progress in our study of these infectious forms, and learn the essential pathologic feature of the various infections, we must hope for names which will be here too pathologically descriptive. At present they are grouped together simply for purposes of study, and to separate them from the two preceding types.

Gout.

There yet remains one type, older than any of the previous classes, which we must briefly mention, since it comes under the general heading of chronic non-tubercular joint lesions.

Gout is too well recognized, and has been too thoroughly studied, to need more than mention in such a superficial paper as this. The tophi are its most striking characteristic, and the Roentgen Ray pictures almost diagnostic by the early loss of bone tissue in the shafts as well as by the articular lesions.

The object of this rough classification, as has been stated above, is for purposes of study. It is evident to all who have had any experience with chronic joint lesions, that only by thus separating types can we satisfactorily investigate these perplexing conditions.

Without attempting even to outline our embryonic methods of treatment, it suffices to say that it has been proved that very different methods are applicable to the different types, and that these methods may be even, in the different types, diametrically opposite, as, for instance, motion and rest.

The prognosis also varies with the various classes, and it is due our patients to give them as clear a look into the future, as possible. Villous arthritis can be demonstrated by the Roentgen Ray perhaps in the future more perfectly by means of the oxygen injection.

It has seemed to us best to show the slides partly in series and partly in contrast in the atrophic and hypertrophic classes, believing that the essential differences will thus be more conclusively shown.

The infectious types differ so materially from both the atrophic and hypertrophic, in the absence of articular lesions, that these can be grouped together in the slides.

Gout rarely requires the Roentgen Ray for a diagnosis, but has essential features worth emphasizing.

Slides.

You have seen these imperfect reproductions, gentlemen, and I ask you to disprove or confirm these observations in your hospital and private practice.

To us these Roentgen Ray findings seem consistent with the clinical picture, and the pathologic examination.

They offer us at times the opportunity of an independent diagnosis, and always represent a piece of confirmatory evidence important to the physician and peculiarly satisfactory to the patient.

DISCUSSION ON DR. OSGOOD'S PAPER.

DR. GEORGE E. PFAHLER, Philadelphia:—I cannot confirm what Dr. Osgood has just told us, but I am much interested, and I would like to know how he explains the decalcification of the bone near these chronic joint lesions. For instance, in one of his pictures we could see the decalcification as compared with the rest of the bone. The shoulder joint, the outer third of the clavicle, the acromion process, and upper third of the humerus showed more transparency than the rest of the bone.

DISCUSSION OF DR. OSGOOD'S PAPER.

DR. PRESTON M. HICKEY, Detroit, Mich.:—I wish to give voice to my appreciation of the work shown us today. Without going into detail I will refer briefly to the great value of the X-ray in the diagnosis of certain diseases formerly classed as rheumatism. A case was brought into the Children's Hospital in Detroit, a young girl who had been treated for two years for chronic rheumatism. A clinical diagnosis was made of infectious arthritis, as the patient presented all the characteristic Roentgen appearances mentioned by Dr. Osgood.

DR. OSGOOD CLOSING THE DISCUSSION.

As to the decalcification of bone in the neighborhood of the joints occurring in these types of cases, I am not perfectly sure that the explanation which I offer is the true one. I have noticed it, however, not only in cases of these types, but in many others. I think it is due to disuse and to some possible neurotrophic disturbance, and not to the lesion in the joint.

The ends of the bones are naturally of finer structure and show trabeculation more clearly than do the shafts. It is here, therefore, that the first evidence of atrophy is seen. There will be certain difficulties encountered in attempting to separate these various types., Many pathologists, from examination of postmortem specimens, feel certain that the two processes of atrophy and hypertrophy are often found in the same specimens and they, therefore, conclude that these conditions which we have called "atrophic" and "hypertrophic" arthritis are simply different stages of the same disease. The explanation of this fact seems to us to lie along these lines.

In the body are constantly going on waste and repair processes; new bone is being formed; old bone is being carried away. Both atrophic and hypertrophic arthritis are characterized by periods of remission and exacerbation. If, for example, in an atrophic case with erosions of cartilage, a remission occurs, the normal repair processes going on, new bone will be formed at a point of erosion. In the hypertrophic type, also, we may conceive a spicule of bone to project until it impinges upon the cartilagenous surface opposite or anchyloses the joint, in which case there will naturally be found an erosion of cartilage, and perhaps atrophy from disuse.

The pathology, to be significant, must be studied in the fresh specimens, and only thus do we feel that an accurate opinion can be rendered as to the essential processes in these two types.

A ROENTGENOLOGICAL STUDY OF CERTAIN MANIFESTATIONS OF SYPHILIS.

Percy Brown, M. D., Boston.

A cursory glance at the title of this paper might easily convey the impression that it is to deal necessarily with a subject more of interest to the scientific observer than of practical value to the clinician. For the following reasons, however, the writer feels to some extent justified in presenting the subject of syphilis:

First. The tendency of medicine, in its various surgical branches, is more and more toward the accurate differential diagnosis between conditions, immediate and remote, obtaining in the bones and joints, which have hitherto been lazily grouped under the heading of "chronic rheumatism," and the symptoms of which, objective and subjective, have been encumbered with various names, ranging from "growing pains" to "paralysis." To aid us to escape across this stream of unenlightening generalities, the Roentgen Rays have cropped out as the most prominent stepping-stone, and it is not only with regard to subtle joint lesions, but also in the later and more obscure manifestations of syphilis, that they have become of really practical value. It is fortunate that this is so, for the knowledge of the existence of these manifestations is established by the Roentgen method at a period in the course of the affection when the results of visual and tactile examination are often most imperfect. To the syphilographer or surgeon the primary and early secondary picture is only too familiar at first glance; it is later in the course of a case, when the early history may be obscure, that the diagnostic method by X-Rays proves its worth.

Second. We have, fortunately, in syphilis, a method of treatment by drugs which is practically specific and almost always certain in its action; so much so, that the effect, or non-effect, of these drugs may be employed as a means of diagnosis, by the process of exclusion, in cases where other diagnostic methods may lead to imperfect conclusions. It must occasionally happen, then, that a person quite innocent of any infection is subjected to large doses of the iodide of potash for long periods of time to the extreme detriment of his digestive apparatus. If a definite understanding of the etiology in such a case can be come at by means of the Roentgen method, what is its value, if not prac-

tical? Also, if, as the writer is informed by a prominent syphilographer, certain cases never respond to treatment, is not the need of a careful Roentgen examination the greater?

A third reason, which might properly be a subdivision of the first, is that syphilis is an affection wherein an accurate previous personal history from the patient is either not obtained at all, or else given grudgingly, and the medical man is left quite in the dark as to the real cause of the pains and aches complained of months, or even years, after. The X-Ray plate, which can be made easily without exciting suspicion as to the exact reason for which it is made, will, however, instantly reveal what has been sought after by unavailing oral examination.

Fourth. After the diagnosis has been established, it is easy to observe, by means of subsequent Roentgen examinations, the progress of the disease or the regenerative effect of medication. Since proper treatment requires a long period of drug exhibition, such X-Ray exposures, for purposes of record, will be more numerous and consequently the more valuable.

It is for these reasons that the writer is of the opinion that the Roentgen method of diagnosis, as applied to cases of late acquired and congenital lues, is of definite practical importance, and should be employed in every suspected case both for the sake of the practitioner's enlightenment and for the patient's ultimate good.

The structures which, in syphilis, naturally present themselves for X-Ray examination are the bones and joints with their intimate appendages. It is well known that these are the tissues often affected in the third stage of the acquired and in the congenital forms of the disease. It has been said that the diaphyseal extremities of the long bones are the regions often affected in tertiary lues, but the tables of the skull are also very often involved, and less frequently the clavicles and ribs. It is the purpose of the writer briefly to consider the most important histological elements of the pathologic process and to describe their appearances as seen in the Roentgenograph.

The so-called bone gumma is the isolated lesion most frequently seen clinically. It is of an inflammatory nature, usually of subperiosteal origin, and if so,

its appearance is characteristic and easily to be recognized on the X-Ray plate. It appears as a localized swelling involving the periphery of the bone, over which the periosteum is thickened and irregular. The extraosseous soft parts may also be involved in the swelling. Gummata may, however, arise in the medulla, in which case they are to be diagnosticated by X-Ray only when they involve to a greater or less degree the endosteum. The endosteal foci may be simply discrete areas of endosteitis, or may amount to actual endostoses.

As the course of a luetic bone lesion advances, certain changes take place within and around the gumma which are easily to be recognized on the plate, and which I will attempt to demonstrate to you by means of these prints. For some of this material I am greatly indebted to Dr. Abner Post, of Boston. The Roentgenographs of the pathological specimens were made by me from some of those in the Warren Museum, of Harvard University.

Following the establishment of the inflammatory node, a caseous degeneration and resorption of the bone takes place, which may amount to an isolated erosion here and there, or to a most extensive caries, often followed by necrosis, honeycombing the bone about the area of infection, and resulting in the characteristic appearance as of coral formation which can be recognized from the X-Ray in certain cases. As a result of these profound inflammatory changes, numerous osteophytes are formed, giving rise to the characteristic dense hyperostoses, which are so commonly seen in the radiograph. The endosteal phenomena, briefly described above, may at the same time take place in varying degree, and the bone may acquire, at the expense of its normal cancellated structure, a condition of extensive sclerosis and eburnation. It sometimes happens that this condition of gummatous osteomyelitis and endosteitis results in bone rarefaction, followed by osteoporosis and a complete breaking down with the formation of sequestra.

These pathological processes, namely, gumma formation, resorption, caries, necrosis, hyperostosis and sclerosis present certain definite shadows which I have attempted in a measure to demonstrate and which, when observed and considered carefully, make up a complex seen in no other morbid condition.

An interesting form of syphilis, although less often intelligently observed, is that of the new-born. The

process in these cases, as seen by the Roentgen method, involves chiefly the diaphyses of the long bones, consequently giving to the bone cortex, at these points, a curiously laminated appearance, as if, in the early stages of ossification, the bone had been deposited in layers or strata. The condition of the diaphyses at the epiphyseal lines is also characteristic. The extreme margins present a serrated edge, which, in some cases, seems almost to approach a condition of fimbriation. These changes, taking place in the extremities of the diaphyses, lend an appearance of extreme disproportion in development between epiphysis and diaphysis. The relative infrequency of congenital cases recorded by Roentgen workers is due, I believe, more to the fact that, as such, they are not often referred to them, than because they are of infrequent occurrence.

Conclusive as the above group of appearances would seem to be, there are, nevertheless, certain chronic conditions involving bone which might, at first glance, lead the observer to think of syphilis, so far as the Roentgenographic appearances go. We should certainly class in this group old osteomyelitis, osteosarcoma, post-typhoidal periostitis, Paget's disease, and rhachitis.

The old osteomyelitis is to be recognized by the fact that, as a rule but one anatomical region is complained of and that its counterpart on the other side of the body, when Roentgenographed, presents no abnormality. In syphilis, on the contrary, both tibiae, for example, may be seen to be affected although but one may offer subjective symptoms. In osteomyelitis although there may be profound changes in the medullary canal, the thickening and sclerosis of the cortical layer is not so typical. In cases of marked syphilitic osteomyelitis, with sequestral formation, the differential diagnosis by means of the X-Ray plate, per se, may be extremely difficult, but an inquiry into the previous history will usually elucidate matters.

It is not, as a rule, so difficult to separate this condition from osteosarcoma. The immediate area occupied by a sarcoma is typical, and there is nothing in the gamut of the syphilis complex with which it could be confused, except possibly in a case where there were many confluent gummata with much osteoporosis. The usual lack of multiplicity of sarcomatous lesions may be a distinguishing factor, as is also the relative rapidity of their course.

Paget's disease of bone, or osteitis deformans, so-

called, may closely simulate syphilis, both objectively with regard to the patient, and on the X-Ray plate. It may involve counterparts; its development may be slow and its gross external appearances are often similar. On the Roentgenograph, however, the periosteum in Paget's disease has usually nothing of the roughened, thickened and exfoliated appearance of lues.

Post-typhoidal periostitis may be suspected from the history, obviously. In the cases seen by me its appearance in the plate is usually as a sharply localized raising of the periosteum, beneath which a typical vacuolous condition. There is generally little circumfocal disturbance.

It is possible to confuse congenital syphilis with rhachitis. In the Roentgenograph there is presented in both the same relative disparity between the lower ends of the diaphyses and the epiphyses. In rhachitis, however, the disturbance is at the epiphyseal line, and the hypertrophy of the diaphyseal ends is often one of abnormally active ossifying action therein. In syphilis, as has been said, the diaphyseal disturbance is one of hyperostosis and sclerosis.

Of less usual occurance, but withal presenting some of the most beautiful evidences of the syphilitic process to be seen on the Roentgenograph, are the arthropathies of nervous origin described by Charcot. These are seen often as one of the concomitants of tabes dorsalis, but are not necessarily well-marked in proportion to the stage of advancement of the disease. Since syphilis has now come to be considered seriously as the etiological basis in the majority of these cases, a description of the arthropathic condition may not be out of place in this paper.

The Roentgenographic plate of the "Charcot joint" presents, first, evidence of rarefaction and atrophy of the articular extremities, which sometimes amount to actual morphological change, resulting in subluxation or complete luxation; second, the more striking appearances of exuberant bone formation, which may involve the capsule and other synovia, the ligaments, tendons and muscle attachments. The pronounced character of these shadows, in a marked case, tends to cause an obliteration of the atrophy obtaining in the articular extremities. Accompanying this text is an illustration of the lateral aspect of the knee-joint in such a case, which I saw through the kindness of Dr. Charles F. Painter, of Boston. The typical changes are easily to be made out.

Very little may be said about technic in these cases of lues, for the procedures are usually simple enough. In congenital cases occurring in the very young, it may become necessary to employ an anaesthetic, for immobility is essential where a differential diagnosis of subtle lesions is to be made. The writer has found it very difficult to make a full-timed exposure in some cases of Charcot's joints, on account of the tremor which was met with. This tremor is especially hard to overcome in exposing the anteroposterior position of the knee-joint.

In conclusion, the writer would repeat and emphasize his previous declaration that to make Roentgen examinations in all suspected cases is very necessary. If, by so doing, the operator can relieve personal anxiety in determining a supposedly positive case to be negative, or, on the other hand, can open the road to proper medication and care in a given case by declaring it to be positive instead of negative, he has afforded himself an opportunity for eternal self-congratulation.

DISCUSSION ON DR. BROWN'S PAPER.

DR. HENRY K. PANCOAST, Philadelphia:—Dr. Brown's paper has been most instructive to all of us, and we will all agree that the prints he has shown in connection therewith are most excellent, and as they would undoubtedly be very valuable to us in the future for reference, it seems as though there should be some means of having them on record for the benefit of every one interested in this subject. Some plan ought to be adopted whereby such valuable skiagraphs could be included in our transactions. Dr. Johnston has suggested that all prints shown in connection with papers read at these meetings, and of sufficient value for reproduction, could be included in the transactions at an additional cost of one dollar per copy.

DISCUSSION ON DR. BROWN'S PAPER.

DR. GEORGE E. PFAHLER, Philadelphia: I want to emphasize what Dr. Pancoast said. During the past year I often felt the need of referring to the excellent work Dr. Hickey did in studying the epiphyses of the elbow joint, but unfortunately the prints were not available. This matter ought to be given some attention by the society. I for one would be very glad to pay one dollar for the volume of transactions if it contained these prints.

DISCUSSION ON DR. BROWN'S PAPER.

DR. FREDERICK H. BAETJER, Baltimore, Md.:—I was particularly interested in Dr. Brown's paper, because we see so many cases of syphilis in Baltimore. Before we had the X-ray so many of these cases were diagnosed as cases of osteomyelitis. Now we can diagnose them correctly, which has materially altered the treatment and, of course, the clinical result. When there is suppura-

tion, with bone being thrown off, unless very extensive, we do not do as we did before the time of the X-ray, do a radical operation, but we usually put them on the anti-syphilitic treatment, and we find that these cases do very well, the mild ones healing up very nicely. With the X-ray we can trace the course of the disease very nicely. I think that many cases of so-called osteomyelitis, if looked into with the X-ray, will turn out to be of syphilitic origin.

DR. BROWN, closing the discussion:—Dr. Wells's cases apparently are typical. They represent an appearance of the lesion which we may neglect to emphasize, namely, the persistence of the original bone cortex running through the lesion and the exfoliative appearance on the periphery, as if a person had taken a certain amount of Plaster-of-Paris and had moulded it about the bone.

As to the osseous involvement in cases of infection near the elbow joint. It seems to me that we should look first at the lower diaphyseal end of the humerus, and the upper diaphyses of the radius and ulna, for first evidences of the disease about this joint.

Dr. Baetjer's description of the practice, at Johns Hopkins, of opening up these lesions in cases where there is much purulent exudate seems to me to be an especially wise one, although syphilographers have been rather prone in the past to cast surgery aside, rather than to embrace it the proper course of anti-syphilitic medication.

THE TUBULAR DIAPHRAGM IN ROENTGENOGRAPHY OF THE CHEST.

By P. M. Hickey, A. B., M. D., Detroit.

The early interest of the writer in the Roentgen Ray had its origin in a desire to investigate its possibilities as an aid in the exploration of the chest. At first the fluoroscope seemed the most feasible way of utilizing the new force. Accordingly a room was planned which could be completely darkened, and an apparatus was installed which portrayed vividly on the screen gross lesions of the lung and permitted the excursion of the diaphragm to be watched and measured. When these phenomena were demonstrated to the experts in physical diagnosis, they would agree that the demonstrations were very interesting from a scientific point of view, but expressed their skepticism as to any real practical benefit in these new examinations of the lower respiratory tract. The clinician asked if tubercular changes in the pulmonary tissues could be detected earlier with the fluoroscope than by auscultation and percussion. We were compelled to admit that the new method was simply a confirmatory agent in establishing a diagnosis in respiratory lesions, although of paramount value in the investigation of the aorta and in the early diagnosis of aneurism.

With the improvement in apparatus, with stronger tubes and more powerful coils, the possibilities of rapid exposures became greater and the era of the fluoroscope was succeeded by the era of the plate. A negative could be made while the patient held his breath with results which depended on the quality of the tube employed. This technique seemed to be of marked value and to possess distinct advantages over the fluoroscopic examination. It furnished a means of studying in detail the appearance so evanescently depicted on the screen, and of making a permanent graphic record which could be compared with subsequent photographic observations at succeeding examinations. The experts in auscultation and percussion continued their attitude of skepticism as to the value of the Roentgen Ray when compared with what could be learned by the ear.

Let us consider for a moment how radiography of the thicker parts of the body has advanced. Formerly the hip and spine were the bete noir of the Roentgenographer; he rejoiced when called upon to show the ossoeus structures of the wrist or foot, but he found the cancellous tissue of the neck of the femur or the differentiation of detail in the lumbar vertebrae wonderfully elusive of representation on the sensitive film. The discovery of the injurous effect of the inverse discharge and that mist and fog were produced by the secondary rays led to the employment of the diaphragm. To Albers Schonberg we owe a great debt for the perfection and introduction of this important piece of apparatus. Thanks to Schonberg, the heavier parts of the body yield their records of density with the ease formerly characteristic of the thinner parts.

While we may be able by other means, such as careful adjustment of the vacuum of the tube and the use of mechanical interruptors, to eliminate many of the secondary rays, yet it remains a fact that the diaphragm is necessary with fast exposures. If a patient could immobilize his chest for one or two minutes by holding his breath for that length of time, the electrolytic interruptor could be replaced by the mechanical. In radiographing the chest, if the plate is to possess a maximum value, the exposure must be rapid so as to minimize movement. Movement is as fatal to fine definition in radiography of the chest as it is in the hand or elbow. The nearer we can attain to the instantaneous, the greater will be the diagnostic value of the resulting negative. Hence, if we desire to investigate the chest with an idea

of discovering changes not apparent to the experienced auscultator, we must minimize the time of exposure. Rapid exposures necessitate electrolytic interruptors, which in turn often involve secondary rays which require the diaphragm for their elimination. It must be apparent from a moment's reflection that if the diaphragm is useful in hip exposures, it should be useful in the chest, as the air in the lung delights in the formation of secondary rays.

The use of the diaphragm, and by this term the author means the tubular diaphragm of about 13 centimeters diameter, presupposes the use of small plates. Of a necessity, compression can be of little value in thoracic work. An 8x10 plate allows of an investigation of both apices so that the apex of one lung can be comtared with the apex of the other lung. The diaphragm permits of the careful investigation of the roots of the lung and their frequent glandular changes. We have found that the negative shows changes along the internal borders of the lungs more frequently than at the apex. Apical changes are frequently secondary to infection from the bronchial lymph glands. We believe, and in this belief we have the support of Dr. Schonberg, that the diaphragm will enable us to detect changes in the lung structures, particularly in the apices, before the stethescope can find a lesion.

Probably the part of the lung most frequently the seat of careful examination is the apex. Here we find Roentgenography of the greatest value. The procedure thus far found of value may be summarized as follows: The patient lies upon his back with only a thin support under his head. The hands are crossed over the abdomen so as to widen the space as much as possible between the scapulae. An 8x10 plate properly protected is placed underneath the neck so that the region of the apices may correspond to the plate. The diaphragm is moved as close to the neck as possible with the lower edge touching the lower surface of the chin. The angle of inclination will be adjusted so that the light axis is slightly oblique to the plate. The angle should be studied with reference to the shape and contour of each chest to be investigated. The best plates are those in which the shadow of the clavicles falls in the lower part of the third intercostal space and does not superimpose at all on the first and second intercostal spaces. To attain such plates each case must be individually studied and the diaphragm adjusted in a careful manner. If

Roentgenogram of pleural thickening on right side; this appearance should not be confounded with consolidation.

the clavicular shadows cover the apices the value of the examination is lost. The nearer the light axis passes through the sixth cervical vertebra, the less will be the distortion.

With regard to exposure, it should be as short as possible, having due regard for proper penetration. Longer time seems to be required with the diaphragm than when the latter is not employed. The criterion of the developed plate must be fidelity of the rendition of the soft tissues and not of the bones. Negatives which may be brilliant in their display of the osseous structures may show little details in the pulmonary organs. The choice of a tube is probably the most important factor in the successful production of satisfactory chest negatives. A tube reading a full Walter five or a scant Walter six will have sufficient penetration for the apices of a thin chest. For a thick chest, a brilliant Walter six is necessary. In order to minimize the time of exposure, a tube of low internal resistance should be selected so that it will permit enough current to pass to cause the milliampere needle to read 10 milliamperes with a penetration of Walter six. This can be secured by a so-called seasoned Grundlach tube which, according to the writer's idea, simply means that the original molecules of oxygen and nitrogen have been absorbed by the terminals in the tube and replaced by hydrogen admitted through the osmosis regulator; after the substitution is complete, the internal resistance falls so that enough current is passed to do rapid work. Any modern coil will furnish all the current necessary if the tube will allow it to pass through. The exposure therefore is estimated by the Walter scale, the equivalent spark length and the milliampere reading.

After a plate has been made of the apices, the region to the right of the sternum can be rayed so as to investigate the root of the right lung. Here the light axis should be perpendicular to the plate. Similarly a plate may be made of the left lung. When this plate of the left side has been made, another will often be found advantageous in which the light axis is inclined from without inward so as to separate the aorta from its adjacent tissues. Plates should be exposed from back to front to render the examination complete.

In cases of advanced consolidation with cavity formation where it is desired to accurately determine the size and shape of the excavations, a time exposure may be necessary, unless all the conditions are favorable for

very rapid work. The density of the diseased tissue coupled with the difficulty of suspending respirations often prevent satisfactory penetrations, unless the tube is of the best. While there is usually no difficulty in recognizing by auscultation a cavity of appreciable size, the stereoscopic image gives us a concrete idea which is much more definite. The production of the two negatives upon a divided 11x14 plate so that each occupies a space 7x11 inches with subsequent fusion with a prism stereoscope possesses many advantages.

The practical results of this method are the successful demonstrations of pulmonary lesions when still unheard by the stethescope. Now that the importance of the early detection of a pulmonary tuberculosis is becoming universally acknowledged, this reliable means of early diagnosis should be welcomed. It furnishes an important means of investigation of the bronchial lymph glands, whose infection so often leads to adjacent contamination of the lung parenchyma.

It is not the intention in this brief paper to disparage the use of the fluoroscope or large plate as each method of examination has its advantages and limitations, but to suggest the small plate made with the diaphragm as the method which gives the greatest amount of information in regard to the density of the lung area investigated.

In the interpretation of the negative thus obtained experience and care are necessary. The position of the clavicles should be carefully noted and their sternal ends, which are somewhat indistinct, mapped out. The first rib on each side should be studied so as to find its anterior representation. These often cause some confusion. The edges and spines of the scapulae should be located. These few bony landmarks having been recognized, the attention can be turned to the intercostal shadings. The first intercostal space of one side can be compared with its fellow of the opposite side. Massive consolidation prevents any darkening of the intercostal space. Isolated tubercles of appreciable size are plainly depicted. Slight shadings, indicate slight increase in the pulmonary density. The shadings along the sternum in the 4th, 5th and 6th interspaces are often hard to interpret. Rounded dots often indicate enlarged glands, and should be differentiated from linear shadings suggestive of the pulmonary vessels.

In advanced cases the size of cavities is more easily made out than in the large plate. Thickening of the

Roentgenogram of Normal apices.
Patient lying on back with plate under neck.

pleura causes a diffuse shading which must not be confounded with massive consolidation. These are nly a few suggestions as to conclusion. The Roentgenologist will, as his experience increases, naturally draw more extensive and more accurate conclusions from his plates.

The points to be emphasized may be grouped as follows:

First. The small negative made with a tubular diaphragm shows more detail of lung structure than the large general plate.

Second. The early changes in the tuberculosis of the lung are easily shown in the diaphragmed plate.

Third. The diaphragmed plate often is more accurate in detecting small areas of pulmonary change than the stethescope and often anticipates the latter instrument.

Fourth. The small diaphragmed plate while not to be advocated as replacing the large plate has a distinct field of usefulness.

DISCUSSION OF DR. HICKEY'S PAPER.

DR. KENNON DUNHAM, Cincinnati, Ohio:—Dr. **Hickey** has given us some very beautiful work which will help in the diagnosis and treatment of tuberculosis. In treatment results depend upon an early diagnosis, and here accuracy is everything.

I believe that this work will lead to a great deal of just such discussion as we have had. What are the shadows? What do they mean? That is why we must be extremely careful in interpreting our plates. For several years I have been making plates of the lungs, not for the purpose of making a diagnosis, but as a confirmation of what I see with the fluoroscope. I started in to examine chests with the fluoroscope after Williams' book appeared. The longer I worked the more impressed I became with the value of the fluoroscopic examination of the chest. My pictures were taken somewhat differently from Dr. Hickey's technic, but it was done more as a confirmatory work than as a means to absolute diagnosis. The technic I used was not nearly so good. I see now what was wrong.

The picture was made with the chest to the plate and the arms in the position of a swimmer, and I got the clavicle over the apex. That was a mistake. The clavicles must be down in the intercostal space, as Dr. Hickey told us, because the place where we look for the first evidence of the disease is in the apex of the lung and just beneath the clavicle. However, if you do not lose sight of the valuable work done by Williams, you will get a very great deal of information from the fluoroscopic examination. I have often demonstrated the possibility of making a diagnosis of the presence of tuberculosis from three to six months prior to the clinical diagnosis. If I make a careful fluoroscopic examination, and can confirm these findings with my plates, I feel that I have

made as sure a diagnosis of tuberculosis as finding the bacilli microscopically would give me.

DISCUSSION ON DR. HICKEY'S PAPER.

DR. GEORGE E. PFAHLER, Philadelphia:—My technic corresponds almost exactly with that of Dr. Hickey, and, I think that I can say pretty definitely that with the X-ray and careful technic you can make a diagnosis of tuberculosis of the lungs earlier than you can by any other means. I have had the opportunity of measuring, side by side, my ability in this direction with some of our best clinicians, and the latter recognized the superiority of the X-ray over the usual clinical methods.

I have always felt that the fluoroscope is a good thing, but I recognize most distinctly that it is a dangerous thing. That is why I have practically discarded it. The use of the fluoroscope is not necessary when you can learn all you need to know or want to know about the lungs if you will employ the excellent technic of examination that Dr. Hickey has described to us. By first exposing the whole chest and then a certain part of which you may want more definite information, you can make a permanent and accurate record, one that is far ahead of any fluoroscopic examination and without any danger to yourself or to the patient.

DISCUSSION ON DR. HICKEY'S PAPER.

DR. MIHRAN K. KASSABIAN, Philadelphia:—In 1902 I reported at the Congress of Tuberculosis, in New York, on the value of the X-rays as a means of diagnosis in the incipient stages of tuberculosis, and I had the privilege of making examinations at the Medico-Chirugical Hospital, Philadelphia, with the best clinicians in the country. At that time I used to expose the chest for from three to four minutes. My report embodied about ten cases, which were diagnosed with the fluoroscope and skiagraphically in the pre-bacillary stage, and my diagnosis was confirmed afterward. Although we do not expose so long now, still we get the same results.

When both apices are involved it is very difficult to make a diagnosis because we have not a normal side with which to make a comparison, and the apices of the lung cannot be compared with the lower portions so far as transparency is concerned.

With regard to the light spot in one of the negatives, I think that the darker spot is due to an emphysematous condition of the lung on the unaffected side, because when the apex is involved the diaphragm on the affected side becomes less mobile, and therefore that side of the lung becomes emphysematous. This gives us these darker spots representing lung tissue that contains more air than the other side.

I would like to ask Dr. Hickey about the immobility of the diaphragm on the affected side. That has not been explained by anyone as yet. It is considered a sign of pulmonary tuberculosis, but the reason for its existence has not been explained. I also believe that a pleurisy throws an equal or less shadow than the rib; that is, the shadows of the ribs are visible when the pleuritic thickening exists; but when consolidation exists in the lung, the shadows of the ribs are obscured.

DISCUSSION ON DR. HICKEY'S PAPER.

DR. A. CLIFFORD MERCUR, Syracuse, N. Y.:—It seems to me that it is interesting to remember that one reason why the photographic result is better than the visual result is the fact that the same portions of the retina are not involved in day vision and in night vision. In recent physiologies it is stated that we use different histologic elements in our night vision, and that night vision, therefore, is far inferior to day vision. Accordingly as fluorescent examinations are best made under conditions of night in a dark room, we never can expect to see the definition on the screen, even if it is there, that we see in photographs.

An interesting matter which has come out in connection with this lung matter is that Dr. Lawrence Brown, of Syracuse Lake, N. Y., has learned to percuss on inspiration and expiration and get the same results as he does in his X-ray pictures. He is able to determine the movement of the diaphragm by percussion, as well as he can determine it by the X-ray picture. He has carefully compared the two methods.

Another thing; we are talking about making the earliest possible diagnosis of tuberculosis with X-ray. I believe that the time is coming when this will all be put aside for the tuberculin test, the only sure test in doubtful cases.

DISCUSSION ON DR. HICKEY'S PAPER.

DR. HENRY HULST, Grand Rapids, Mich.:—The diaphragm motion which has been mentioned, the so-called Williams' sign, frequently occurs in other affections, which are not related to tuberculosis in any way. Thickening of the pleura is very apt to deceive, but after all a local thickening of the pleura at the apex, nine times out of ten, indicates tuberculosis.

The first picture Doctor Hickey showed has less penetration on the left than on the right side. We have noticed this even when there is no disease of the lung. Turning of the body around its long axis will change the relative density. The difficulty in studying a fine plate is to see only what is really there and not to see too much. In order to get detail we must have the patient quiet and at rest. That applies to all skiagraphy.

A quick exposure by itself, irrespective of the immobilization of the diaphragm or the lung produces results. The finest detail is secured with the quickest exposure. If you can make a picture in a fraction of a second it is better than in a second. By long exposure of the lung with the compressing tube you lose what you might gain by shortness of exposure without the compressor.

I have not done such work with this diaphragm as has Dr. Hickey. If you want to study a cavity well, it does add to the beauty of the work. You can get just as good detail in your finest picture without using this compressor-diaphragm, provided you go at it rapidly.

When you can find the bacillus with the microscope, the use of the X-ray is limited to determining the extent of the disease. To determine the question of lung tuberculosis in the prebacillary stage, before the bacillus is found in the sputum, is always ticklish work. To make a diagnosis at that time from the plate requires a good deal of experience. Sometimes you will get a case in which the bacillus is not found in which it is easy to make the

diagnosis. Dr. Willey showed me a plate at the University about which there was some doubt. I diagnosed tuberculosis, even though it was impossible to find the bacillus. Some of these pictures are so characteristic that it is impossible to mistake them. Theoretically speaking, a mass of tubercles ought to produce a mottling. Sometimes we get only dense shadows simulating a thickened pleura. Then you must be careful. Williams was able to detect a normal difference between the two apices. He may be able to do so, but I can not. I would caution people, however, to make a diagnosis on the diffuse shadows of the apex. If you want to make a diagnosis of apical tuberculosis you ought to find more than a slight difference in density. You ought to turn your patient around several times. Always interpret your picture in the light of what you find with the fluoroscope. To discard the fluoroscope entirely is one-sided. Do not do it. Although I champion quick exposures in skiagraphy of the chest, I do advocate fluoroscopy as well, and I can see an immense benefit in the use of the diaphragm not only in apical disease of the lung, but in disease of every other part of the body where you want detail. Most of us have not used the diaphragm as much with the fluoroscope as we ought to. You can get a beautiful fluoroscopic view of the apex if you have a good diaphragm; and, then, for the sake of having a record, take a skiagraph and you will do better still.

DR. HICKEY, closing the discussion:—I was very much pleased at the interest shown in the plates. The interpretation of these plates is a matter of the greatest difficulty, and only by profitable discussion will we arrive at anything that is of value to us in our work.

My paper was not written in disparagement of a large plate or of the fluoroscope, but the object was to bring out the use of the diaphragm, which shows increased detail in the parts of the lung that we wish to examine.

In regard to taking plates of the lung inflated and empty, I only made one experiment and that was two years ago, and the data were insufficient to draw any conclusions from. It is difficult for the patient to suspend respiration with the air in the lung minimized It is better to take the picture while the chest is moderately full of air, as the patient is then least likely to move.

RADIOGRAPHIC MEASUREMENT OF THE DIAMETERS OF THE FEMALE PELVIS AND NEW TECHNIQUE IN RADIOGRAPHING VESICAL CALCULI.

By G. E. Pfahler, M. D., Philadelphia, Pa.

Probably the most critical period in the life of a woman is that of the birth of her first child. Two lives are at stake at this time. Much of the uncertainty could be eliminated if the attending physician could determine accurately the diameters of the pelvis of the mother; and if with this he could know the exact size of the child's head, the case could be dealt with in the most skillful manner.

If the diameters were found to be contracted premature labor could be induced, or all provisions could be made to assist in the labor before the woman became exhausted, or a Caesarean section could be performed and in this way the lives of both the mother and the child could be saved.

Obstetricians have done much toward accomplishing this result by taking external measurements of the pelvis, and by measuring approximately the internal diameters. Accuracy has, however not been obtained though very much desired.

It is this long felt want that prompted one of our obstetricians, Dr. W. Frank Haehnlen, to suggest to me the use of the Roentgen Rays for this purpose. Scattered attempts have been made to measure the diameters of the female pelvis by means of the Roentgen Rays, but in general the methods used have not been found practical. Even the method that I shall describe, though it seems very simple, may not be found practical.

On account of the mass of tissue to be penetrated in a pregnant woman it will be found difficult by any method, and it is likely that only those who have perfected their technique and are able to make short exposures will feel justified in attempting this work. Stereoscopic radiographs might be made, but this will necessitate two exposures, and in the light of recent experiments (which I believe to be exaggerated in importance) it is desirable to make a single exposure and that as short as possible.

It was as a result of the suggestion of Prof. Haehnlen that I have developed the following technique and

apparatus for the purpose of measuring the diameters of the female pelvis.

This, as any other technique which has for its end result accuracy, must have accuracy as far as possible in every little detail. Unless each measurement is taken accurately the end result will be inaccurate and will be of more annoyance to the physician than assistance.

The principle upon which this technique is based are as follows:

1. The plate must be placed parallel with the brim of the true pelvis.

2. The distance of this pelvic brim from the anode must be measured as accurately as possible and recorded.

3. The anode of the tube must be placed in the axis of the plane of the brim of the pelvis.

4. The exact distance of the anode from the plate must be accurately measured and recorded.

If these four principals are accurately followed the diameters of the pelvis will be accurately determined. Any error in the observance of these four principals will necessarily give an error in the end result. Therefore our whole attention will be occupied in providing means to observe these four principals:

1. For the purpose of placing the plate parallel with the brim of the pelvis I have constructed a Radiographic Pelvimeter, which consists of a base board 10x24 inches. At a distance of 9 inches from one end is placed a second board 10x11 inches, at an angle of 30 degrees, which is the angle of the plane of the brim of the pelvis with the body. This is supported by a triangular piece of wood. This "Radiographic Pelvimeter" is placed upon any radiographic table. The patient is placed upon the base board with the buttocks and coccyx resting upon the bracket. This bracket will then correspond to the plane of the brim of the average normal pelvis. By means of a mattress, the body is raised about three inches so as to bring the entire shadow of the brim of the pelvis upon the plate. Patients prefer to lie upon a mattress, and since it in no way interferes with the accuracy it is an advantage rather than an objection. The plate is then placed upon this bracket beneath the pelvis. The thighs are flexed upon the abdomen and rotated outward. They may be supported by means of a bandage extending from the hook at the end of the base board.

2. We must now determine the distance of the brim from the plate or from the anode. By palpitation the crest of the pubis can be felt, and the thickness of the

fat estimated as accurately as possible, and subtracted from the total distance of the pubis from the plate. The estimation of the thickness of the fat will give practically the only chance for error in the end result. A man should, however, be able to estimate the amount of fat to within an eighth of an inch.

3. The third step is to place the anode of the tube in the axis of the brim of the pelvis. To facilitate this I have placed a rod at right angles to the board holding the plate, and attached it to the middle of the top edge. The median line of the body should pass through this rod. This rod is now parallel to the axis of the brim of the pelvis. We now measure the distance from this rod to the inside of the pelvic brim, which can be felt at the symphysis pubis. To this distance is added 2 inches (half of the normal antero-posterior diameter). A second movable rod attached at right angles to the first rod will facilitate the making of these measurements. (I am indebted to one of my students, Dr. Gaylord, who is a skillful mechanic, for the construction of these rods.) The anode is easily placed in a line with the point obtained by these measurements and is done in less time than it takes to describe it.

4. The fourth step is to measure the distance of the anode from the plate. This of course is very simple. The anode can be placed at any distance. The greater the distance, the greater will be the accuracy, but the difficulty of getting a good radiograph will also be greater. I have found 20 inches most convenient.

Having recorded these factors and obtained a good radiograph, the determination of the diameters of the pelvis is a mere matter of calculation.

The diameters as measured in the radiograph represent the degree of divergence of the rays at the distance of the plate from the anode (20 inches). The question then is, "What is the degree of divergence of the rays at the distance of the pelvic brim from the anode?" (We obtain the distance of the anode from the symphysis by direct measurement, or subtract the distance of the symphysis from the total distance of the anode from the plate.)

Reducing this to a formula, let "A" represent the total distance of the anode from the plate; "B" the diameter as measured in the radiograph; "C" the distance of the symphisis or pelvic brim from the anode, and "X" the diameter of the true pelvis. Then the formula would stand:

A:B::C:X.

Taking as a concrete example Fig. 3, which is a radiograph of a normal skeleton pelvis. The distance of the anode from the plate was 20 inches; the antero-posterior diameter as measured in the radiograph is 5¼ inches; the distance of the anode from the symphysis was 16¾ inches; therefore the antero-posterior diameter of the true pelvis must be 4.29 inches, and this is the correct measurement of the pelvis used.

Taking as a second concrete example Fig. 4, which is the radiograph of a normal pelvis in a living woman (non-pregnant). We have a right to assume that a woman who has given birth to a normal child, normally, has a normal pelvis, the woman being normal in all outward appearances.

The distance of the anode from the plate in this instance was 20 inches; the antero-posterior diameter as measured in the radiograph is 5.5 inches; the distance of the anode from the symphysis pubis was 14.5 inches; therefore the antero-posterior diameter of the true pelvis at the brim is 3.9875 inches. Four inches is given as the normal antero-posterior diameter, therefore this must be considered normal.

This may seem like a complicated method, but it is not, and the only real difficulties will be in obtaining a good radiograph in a pregnant woman, and in determining accurately the distance of the symphysis pubis from the anode of the tube.

We should be careful to place the brim of the pelvis parallel to the plate. This can be done by determining that the anterior superior spines are the same distance from the plate. If the patient is allowed to twist her body, the pelvic shadow will of course be distorted.

This method has the advantages of simplicity and accuracy, with only one exposure.

I began this work only a short time before going away on my vacation. This, with the fact that our maternity wards are practically closed during the summer months, has prevented me from making practical application of the method in pregnant women, and in this way working out some of the practical problems that I feel will present themselves.

New Technique in Radiographing Vesical Calculi.

One of the advantages of the present method of radiographing vesical calculi is that the shadow must be projected a considerable distance before reaching the

plate. This decreases the intensity of the shadow and at times makes it almost or quite impossible to recognize. Another disadvantage is the possibility of having the shadow of the vesical calculi obscured by the shadow of the pubic arch as it is projected forward.

By making use of the "Pelvic Bracket" and the technique described for measuring the diameters of the pelvis (omitting the measurement) we bring the plate nearer to the calculus, and thus increase the intensity of the shadow and the certainty of the diagnosis.

It has not been my privilege to examine a case of vesical calculus since I have adopted this technique. I therefore have no illustration to offer to you. It surely offers some advantages, however, and I see no disadvantages.

I offer whatever apology is due the society for presenting these subjects incompleted, but lack of time and opportunity to date have prevented my completing these investigations. I present these subjects at this time before this body of expert Radiologists because they are purely technical subjects, and for the purpose of receiving criticisms and suggestions that will assist me in further investigations. and with the hope that they may be made use of by others.

DISCUSSION ON DR. PFAHLER'S PAPER.

DR. ALFRED L. GRAY, Richmond, Va.:—This seems to be a very simple and accurate means of measurement, but there is one point that I want to discuss, with reference to the technic for vesical calculi by this method. It has been my custom to have the patient sit on the plate with the body at an angle of about forty-five degrees with the table. This method presents an advantage which Dr. Pfahler's does not. If the patient has a stone in the bladder which is free, it will gravitate to a point nearer the plate in that position than it would in the recumbent position. In Dr. Pfahler's position I do not think that the most dependent portion of the bladder would be the point nearest the plate and the stone would therefore be a little farther away than in the sitting posture.

DISCUSSION OF DR. PFAHLER'S PAPER.

DR. H. W. VAN ALLEN, Springfield, Mass.:—I wonder what the effect of this work will be on the public mind. We know that all sorts of marks on the infant are attributed to fright of mother. Would not the laity attribute marks to the X-ray and also any other evils that might befall the child in later life?

DR. PFAHLER, closing the discussion.:—The suggestion of sitting the patient on the plate is a very good one and a simple one for the study of vesical calculi. It offers at least one objection in stout people, and that is, the tendency not only of the stone to gravitate but of everything else to gravitate as well

and thus obscure the shadows. I do not believe that with an empty bladder the stone will change its position very much whether the patient is in the recumbent or in the sitting posture.

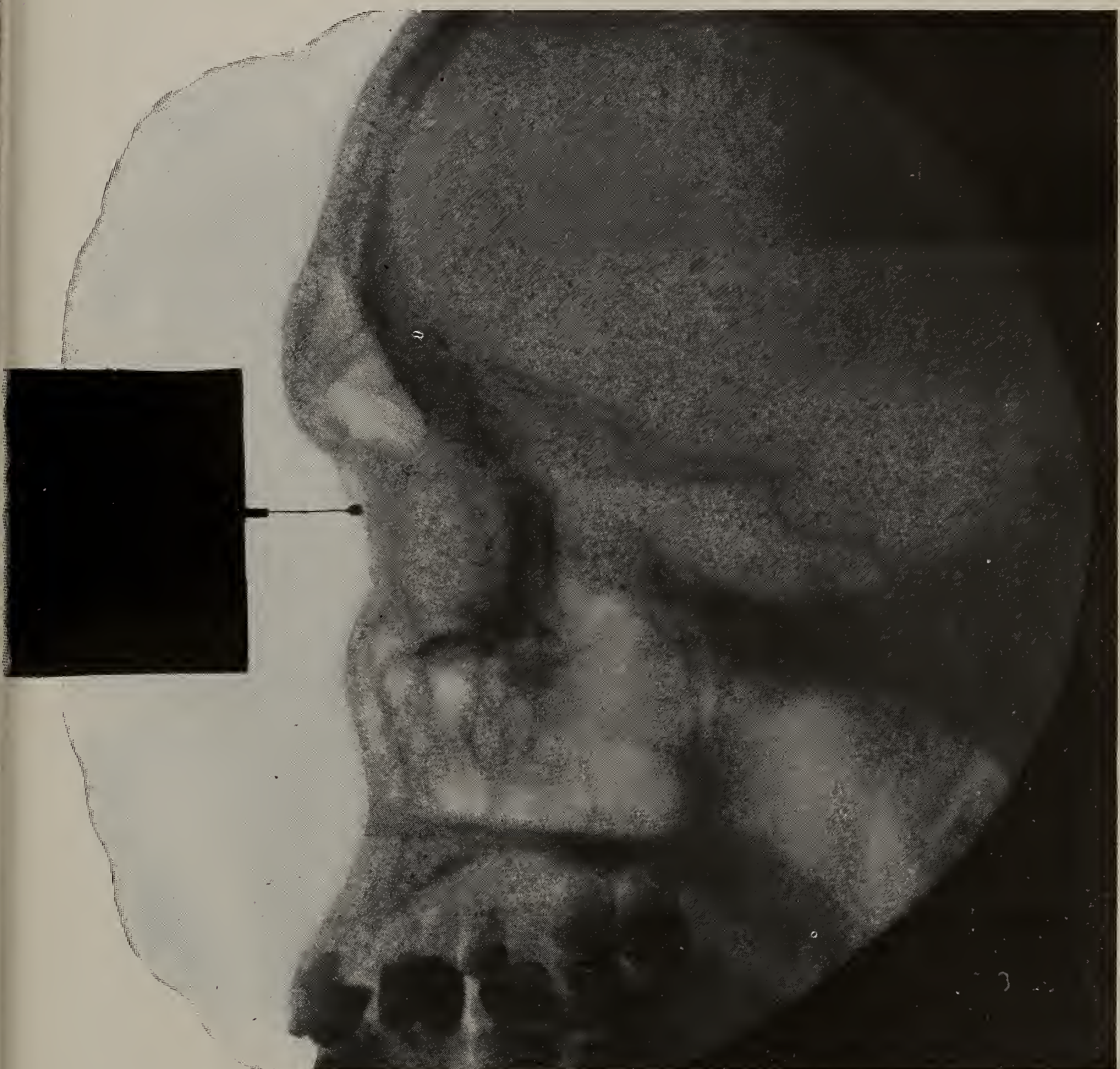
I am very glad that most men feel that these exposures will not be dangerous Of course, all sorts of things will be attributed to this as Dr. Van Allen suggested. This work must be first taken up in hospitals where the patients need not be told of the possible dangers and the ultimate results, since we believe there are no special dangers. They will take it as a matter of course, just as any other pelvic measurements are made. I suppose that years ago, when internal measurements were first made, women attributed marks in the child to that method, but if we really do not get any bad results, the method will recommend itself.

TECHNIQUE FOR THE LOCALIZATION OF FOREIGN BODIES IN THE EYE.

By Charles F. Bowen, Ph. G., M. D., Columbus, O.

The localization of foreign bodies in the eye is perhaps the most important work the radiographer has to do, and as it has fallen to my lot to do much of this work I have developed a technique which has proven very satisfactory and which I will briefly describe.

The apparatus consists in a modification of that first devised by Dr. Sweet of Philadelphia. The same fundamental principles are retained, but the apparatus is changed. Sweet's aparatus, as you know, consists of two balls, these being supported by a plate holder strapped to the side of the head, one pointing to the center of the cornea, the other to the external side of the eye. Two pictures are taken, one with the tube on a level with the two balls, the other with the tube somewhat below the level. The location of the foreign body with reference to the balls in each negative is platted upon a chart and its position is accurately located. This apparatus has not proven satisfactory in my hands for several reasons: First—It is a difficult matter to strap the apparatus firmly enough to the head, without making it uncomfortable for the patient. Second—The patient must sit in a chair or lie on his back, and I find it almost impossible for the patient to hold his head still long enough for a proper exposure. Third—The apparatus cannot be used with the compression cylinder diaphragm. Fourth—In changing plates the position of the apparatus is apt to be disturbed. A device was needed whereby the patient could lie down, the head being firmly held with sand bags, the compression cylinder could be used, and the plates could be changed without disturbing the



Radiogram made by Dr. Bowen's method, showing small piece of steel in the posterior chamber, close to the sclera on the temporal side.

apparatus. It was to meet these conditions that I made this new apparatus.

The compression cylinder table which I use is the one manufactured by Kelly-Koett. The patient lies upon this table with the side of his head resting upon a plate holder which consists of a small table, 4 inches high and 14x17 inches square. In the top of this small table, upon which the patient's head rests, is an opening 8x10 inches, which is guarded by a piece of celluloid. The plate is placed in this opening from underneath, and is held against the celluloid by a trap door. This plate holder table is large enough to allow plenty of room for sand bags to hold the patient's head absolutely quiet. In placing these sand bags two large ones (not too full of sand) are applied at the back and top of the head, and a third, somewhat smaller, is placed on the side of the head.

The balls of the Sweet apparatus are so arranged that they can be raised and lowered on an upright post which is attached to a lead weight about two inches square and one-half inch thick. After the head is in position with the sand bags, the lead weight with the two balls attached is placed upon the plate holder table and moved toward the eye. One ball is placed against the lid over the center of the cornea, the other points to the outside of the eye. The diaphragm of the compression cylinder is now placed above the head in such a way that the light from the tube is thrown through the head directly over the two balls. When the exposure is completed the plate is changed from underneath the plate holder table. The compression cylinder is now moved about three inches toward the patient's body and tilted so that the light will again pass through the balls of the apparatus. The exposure made, the plates are developed as usual. The location of the foreign body is now platted on the chart after the method of Dr. Sweet's. The charts which are ruled in the millimeter scale, as prepared by Meyrowitz, of New York, are preferable.

For locating pieces of steel I use a tube of rather high penetrative power, one which will read about 6 on Walter's International Penotrometer. For locating glass I use a tube of lower penetration, about 4 on Walter's scale. I pass through these tubes for one minute about all the current which can be generated from a 20-inch Scheidel coil. While the tube is in operation I have an electric fan turned upon it, which seems to cool the tube somewhat.

I have examined thirty cases for suspected foreign

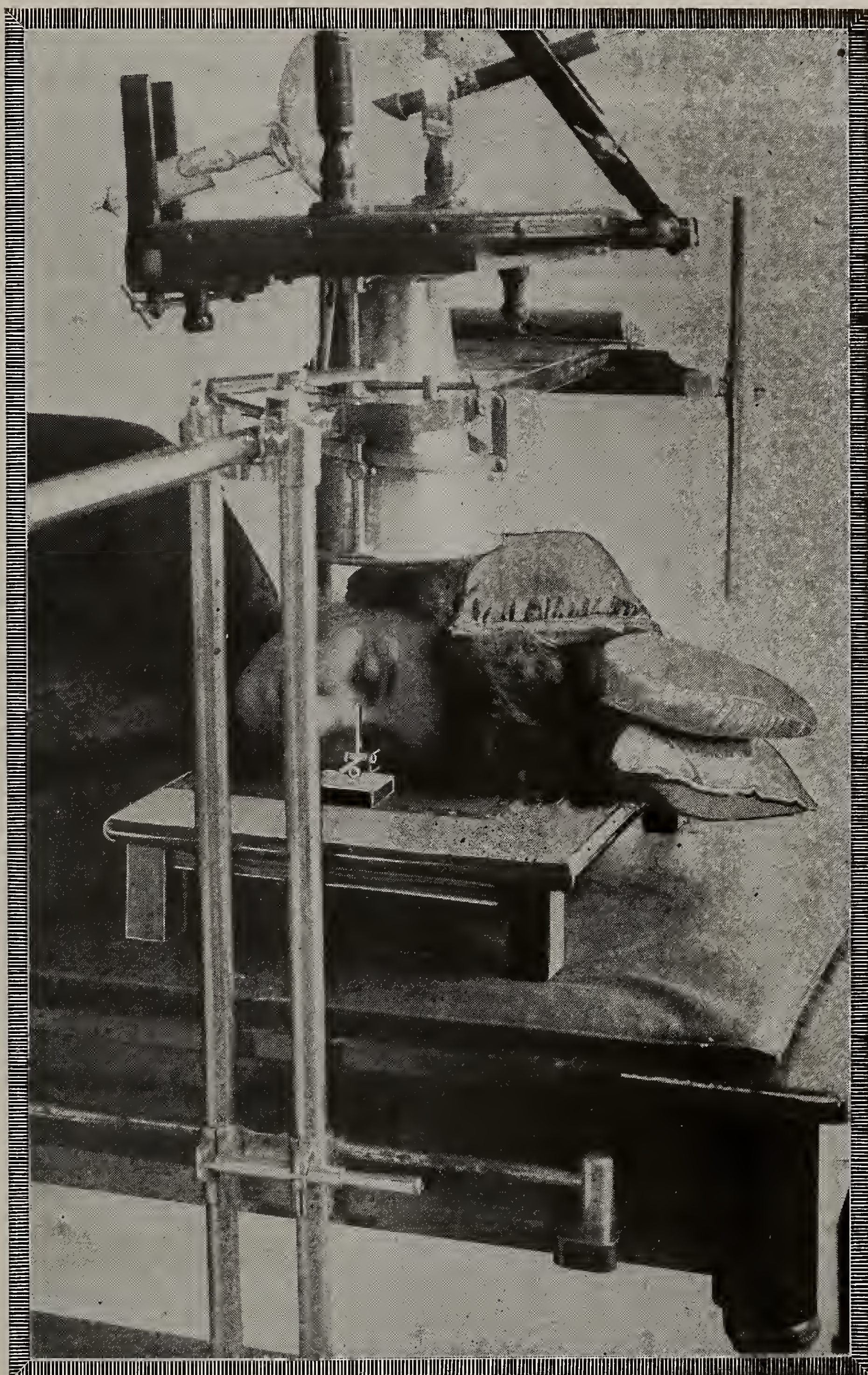
bodies in the eye by this method. In twenty of these cases the foreign body was located, while in the remaining cases no foreign body was present, the pieces having struck the eye and glanced off. A further classification is rather interesting. In seven cases examined for glass I found the body in three. In the other cases it is possible that I overlooked a small fragment, but this is unlikely, since they all recovered with useful eyes and without surgical intervention. Of patients examined for steel, I found the piece in thirteen cases, while in six no foreign body was present. In four cases I found bird shot; in one of these I located fifteen shot in and about the eyes.

In order to illustrate the accuracy of this method I will report a few cases in detail:

Case 1. A piece of steel passed through the sclera, iris and lens, on the temporal side, and was lost in the posterior chamber. Two exposures were made as usual in different directions and the foreign body located on the temporal side, just inside the sclera about half way back, and a little below the horizontal line. The foreign body being so close to the sclera, I decided to take another set of pictures to check the first result. At this examination I located the foreign body about two millimeters from where the first examination showed it, which would bring it just outside the sclera. This was puzzling, and another trial was made. Three consecutive examinations located the foreign body in the sclera, and I then reported to the surgeon the exact location. Under ether an incision was made in the sclera over the exact point where the foreign body was supposed to be imbedded, and the surgeon's knife struck it at once.

Case 2. A railroad engineer, injured by the bursting of a water gauge on his engine, presented a rather large wound of the cornea and iris. Two pictures were taken in the usual manner, but no foreign body could be located. The question was, would the glass cast a shadow? In order to determine this I broke two small pieces of glass from a water gauge similar to the one which bursted, and strapped them to the side of the eye with adhesive plaster. Two pictures were then taken and the small pieces of glass showed plainly. I therefore came to the conclusion that the man's eye did not contain any glass.

Case 3. A man, injured by the explosion of a beer bottle, presented a wound about a half inch long of the cornea and sclera. X-ray examination showed the field



Dr. Bowen's modification of the Sweet method, showing the small table for changing the plates, sand bags, compression diaphragm and lead weight, with small balls for localization.

in the region of the eye to be free from any abnormal shadows. I then proceeded as in the above case to check my results. The small pieces of beer bottle strapped to the side of the eye showed plainly. The subsequent history of this case, and also of Case 2, shows the correctness of my conclusion.

In all cases of suspected glass in the eye where the X-ray examination gives a negative result, I invariably check my technique by placing small fragments of the same kind of glass to the side of the eye and making a second exposure. If these test pieces of glass show, and my first set of pictures show nothing, I then state there is no foreign body present. In one case I located a thin piece of glass from an electric light bulb; in another a piece from a broken lens in eye glasses, and in a third a piece of beer bottle.

DISCUSSION ON DR. BOWEN'S PAPER.

DR. GEORGE E. PFAHLER, Philadelphia:—I appreciate fully the matter which Dr. Bowen has brought before the society. I have been using the Sweet apparatus, and I think that everybody who has been using it will recognize the advance he made when he presented his apparatus, but we have here in Dr. Bowen's apparatus a very simple device and a decided improvement on Dr. Sweet's apparatus.

DISCUSSION ON DR. BOWEN'S PAPER.

DR. PRESTON M. HICKEY, Detroit, Mich.: I was very much interested in this presentation by Dr. Bowen because I have felt the inadequacy of Sweet's apparatus for abolishing the movements of the head. I, too, did some work along this line, but somewhat differently. With Sweet's apparatus the patient sits up with his head strapped in the apparatus. He is subjected to involuntary movement of the head, as caused by respiration, and the head is also moved by the cardiac impulse. So I contrived a frame about 14x17 inches, with three adjustable pads. One is put at the forehead, one at the back of the head, and one under the chin. In addition to these three pads, there is the pressure of the cylinder of the diaphragm, absolutely cutting off all movement. I use a 5x8 plate, instead of two 8x10 plates, making an exposure on each half of the plate. The separate plates are apt to be separated after a time, whereas if you have the two exposures on one plate, this is obviated. The half that has been exposed is covered by lead or some other metal, when the other half is brought into the field and exposed. During the exposure it is necessary to have the patient look at a fixed point.

I always place a bright object some little distance from the patient and instruct him all the time during the exposure to keep the eye fixed on that point.

DISCUSSION ON DR. BOWEN'S PAPER.

DR. MIHRIAN K. KASSABIAN, Philadelphia:—I have used Dr. Sweet's apparatus, but recently I constructed a box, inside of which the patient places his head. One semi-lunar pad is placed in contact with the occiput, one over the forehead and one on top of the head. The patient lies on the table and under the box I made an apparatus as for stereoscopic work, so that I make two pictures while the head is entirely fixed and the patient cannot move his head in any direction. In order to fix the patient's eye, I put a mirror inside of the box, so that the patient can look at himself, which he never fails to do.

I think that Dr. Bowen's arrangement is a very good one for making stereoscopic pictures.

DISCUSSION ON DR. BOWEN'S PAPER.

DR. GEORGE C. JOHNSTON, Pittsburg, Pa.:—In doing this work I have encountered the difficulties that have been mentioned, keeping the head fixed and the eye fixed on a certain point. I have a very handy thing about the office. Get a strip of very heavy canvas, about one-half yard wide and two yards long, and sew it up so as to make a bag. At each end of this bag put ten pounds of shot. For making pictures of the hands or anything else, lay the part to be exposed on the table and place this canvas bag over it, the bag of shot hanging down on either side. Then it is impossible to move the part.

DR. BOWEN, closing the discussion:—I always place the center ball of the apparatus against the eyelid so that the eye must be kept closed. The apparatus has proven perfectly satisfactory in my work.

FURTHER EXPERIMENTAL RESEARCH CONCERNING DIRECT, INDIRECT AND SECONDARY RAYS.

Lewis Gregory Cole, M. D., New York.

In the May, 1905, issue of the Archives of the Roentgen Ray was published an article on "Experimental Research Concerning Direct Indirect and Secondary Skiagraphic Rays." An understanding of that paper is essential and, as the paper was never read before a society, and was published in an English paper, I feel that I must incorporate some of it in this paper.

It was in my early experience with the low vacuum method that I secured on several occasions results of so startling a nature that it led me to investigate more closely the conditions which produced them, in the course of which I obtained unmistakable evidence that better work could be accomplished with an old than a new tube, and that an old, either high or low vacuum tube, would, under other favorable conditions to be dealt

with later on, give off a certain ray or class of rays unobtainable from a new tube under any conditions, and in which were combined the best characteristics of both the high and low vacuum methods, giving perfectly clear outline and marked detail in all parts with short exposure. This I called the "Ray of Selective Absorption."

The Roentgen Ray, considered in the form in which it leaves the tube, has, in its application to skiagraphy, generally been regarded as homogeneous in its character. To so regard it is, I believe, a serious misconception of its true nature which is in a degree responsible for not only many of the unsatisfactory results obtained, but for the inability on the part of the skiagrapher to account for many of those oft-recurring phenomena which are so mystifying.

In the article written in May, 1905, I said I shall assume, whether rightly or wrongly, that the rays in their primary form have their inception at the focal point of the anode, where they may or may not be practically identical in their nature and from whence they radiate in direct lines to the walls of the tube throughout its anterior hemisphere.

Roentgen recognized the fact that the X-rays as a whole were capable of setting up secondary rays in substances with which they come in contact outside of the walls of the tube. a characteristic which has been more fully investigated by Prof. J. J. Thomas to the extent of having determined that the degree of this action is in direct proportion to the density of the object in which it takes place.

But, as far as I have been able to discover, no effort has been made to demonstrate the occurrence of this, or similar process in the walls of the tube itself, although I am aware that Roentgen's original conception of the X-ray was that they were of a secondary nature and produced by the cathode streams in contact with the glass not having a metallic target to be focussed on. I am convinced that there are two forms of rays eminating from the tube, their chief distinguishing features being, so far as they affect skiagraphy:

1. The source of origin. (a) The direct ray from the focal point of the anode. (b) The indirect ray from the wall of the anterior hemisphere of the tube.

2. The direction of the line of flight—this is the case of the direct rays being a continuation of their original line of projection from the focal point of the anode; and

in the case of the indirect rays, being at various angles therefrom.

My belief in this led me to the study of the life history of a number of tubes. In the new tube we have perfectly clear glass of ordinary brittleness and smooth inner surface. Upon its first excitement the anterior hemisphere lights up with a bright, yellowish-green fluorescense; this color gradually changes as the seasoning process advances into a purplish-yellow of less brilliancy. This light Dr. Stover, of Denver, Col., calls the "sunflower" light, because of its rich, mellow color. Eventually, in a very old tube there is scarcely any fluorescense whatever, and Roentgen spoke of this as a dead tube.

After a new tube has been used a few times, the glass begins to assume a purple color in its anterior hemisphere. This increases with the use of the tube, and there is a smoky appearance of the glass of the posterior hemisphere. This purple color of the anterior hemisphere has been regarded by some as a result of the platinum deposit on the inner surface of the tube. I do not believe this to be the case, and further on shall give my reasons for this disbelief.

In the new tube a heavy discharge of current will heat the anode red hot; while the same discharge in an old tube will have no effect. In a fluoroscopic examination with a new tube, it is necessary to place the object near the screen in order to get a clear outline of the bones, but as the tube becomes seasoned this distance may be increased until in an old tube the object may be held at some distance and the bones will still appear with clear, well-defined edges, and the medulary cavity showing.

In the new tube there is not a brilliant fluorescence of the exposed parts of the screen, but a diffusion of light over its entire surface and a corresponding lack of contrast between the various degrees of density of the interposed object.

The Crisis of the Tube.—After a tube has been in daily use for three or four months to the extent of six or eight skiagraphs, and possibly a treatment or two each day, it will be found on some particular day that the vacuum is very high, and refuses to gradually respond to the usual methods employed; but after repeated applications in lowering it, it seems to drop suddenly from a high to a low vacuum and there will be purple rays between the cathode and anode. It recovers, how-

ever, from being lowered, and, if treated moderately for a few days, will pass through this stage and be a most useful tube for six or eight months, or even a year or two.

During the crisis the tube acts most peculiarly. If the face of the anode is turned to the side in one direction, preferably north, or parallel to the magnetic current, you will get a very effective ray from the tube with a 2 or 3-inch spark; then if turned toward the earth, it will back up a 12-inch spark without giving off any rays; and by simply returning the tube to its former position, it will again give an effective ray on a 2-inch spark. This I have demonstrated to the hospital staff. It only occurs on one or two days in the life history of each tube, and usually after the tube has been used for three or four months. This fact I have noticed in every tube which has been used for that length of time. This is what I consider the crisis of the tube. An explanation of these phenomena I cannot give; but that they do occur I am absolutely certain, and that the tube is more effective after passing through this stage, I am equally sure. Carrying the tube up to and through this critical period may be termed as seasoning it.

The vacuum may be raised in a low tube by making and breaking the current repeatedly, preferably by approximating and withdrawing the secondary terminals. This I know will raise the vacuum of the tube, but its modus operandi I cannot explain. If, each time a new tube is used, it be allowed to rest for a day or so, it will bear a greater amount of current without the vacuum being impaired, and eventually, instead of the vacuum dropping, it raises, and the character of the ray improves steadily. Up to this point the power of penetration of the soft parts, and the amount of spark it backs up, seem to be in proportion to the height of the vacuum of the tube.

Changes in the Gas in the Tube—During and presumably as a part of this seasoning process, the gas remaining in the tube seems to undergo some change productive of a higher vacuum. When a tube, which has undergone this process, is re-exhausted, it will act as a new tube, as regards the falling of the vacuum during the period of excitement. If, however, the tube is not re-exhausted, this change continues to increase with the use of the tube until a 12-inch spark, or even a greater, is necessary to effect an excitement; which even then will continue only a few seconds, unless the vacuum be repeatedly lowered by heating the palladium point; but

with even this high vacuum, as before stated, the bones during the intervals of excitement of the tube appear very black in the fluoroscopic examination with an accompanying greater penetration of the soft parts, a combination to which I then applied the term "The Ray of Selective Absorption."

The difficulty encountered in exciting a tube which has reached this condition, owing to the discharge of the current around the surface of the tube, is generally attributed to the presence of the above-mentioned platinum deposit on the inner surface of the tube, acting as a conductor of the current between the poles. While this deposit may exist, I doubt if it so affects the discharge, for the reason that the tube, if re-exhausted without undergoing any known process calculated to remove such deposit, may be excited by a moderate energy, the vacuum dropping as in a new tube, and without the immediate recurrence of the phenomenon.

A seasoned tube produces a brilliant fluorescence of the screen on its exposed parts, this being much diminished where the soft parts are interposed and an almost entire absence of light where the bones interpose, with marked detail throughout the skiagraph.

If a new tube backs up 6 or 7-inch spark the bones are nearly obliterated and the edges are blurred and indistinct, while an old tube may back up a 12-inch spark without increasing the penetration of the bones enough to perceptibly dim their shadow, and in an old tube even the small bones of the hand will appear distinctly black. regardless of the length of spark which it backs up, and the soft parts will each absorb a certain amount of light.

In the meantime, the glass of the tube has become brittle and rough on its inner surface in the anterior hemisphere upon which the radiations from the anode have acted directly, while the glass of the posterior hemisphere is not perceptibly changed from its original texture.

As to the cause of the discoloration of the glass of the tube, I am of the opinion that if this is due to the presence of any metallic substance in any form, it is of aluminum rather than of platinum, for the reason that in the anterior hemisphere, the part of the tube immediately adjacent to the aluminum parts are more highly colored than others, while the portion of the lower half of that hemisphere, which is shielded from the direct rays from the platinum secondary cathode by the intercepting anode, has less discoloration. The different col-

Photograph of specially constructed tube in action. A thin piece of aluminum and a fragment of glass from a broken tube are suspended in front of the anode, midway between it and the wall of the tube. X-Rays pass freely through both of these substances.

The deflected cathode stream is obstructed by the aluminum and glass. Anterior hemisphere of the tube shielded from the focal point of the anode does not fluoresce and does not generate indirect rays. Therefore the fluorescence of the tube and the indirect rays are caused by deflected cathode stream.

orings of the two hemispheres, the purple of the anterior and the brown of the posterior, might be attributed to the different manner in which the metallic particles are deposited upo n or throughout the glass. The glass of the posterior hemisphere being unexposed to the direct discharge from the anode, undergoes less molecular disturbance, and the metallic particles are simply deposited on the inner surface of the tube, while the direct discharge from the anode upon the walls of the anterior hemisphere sets up an intense molecular action in the glass which permits of the metallic particles being carried into and even through the glass. That some of them are carried through the glass, is indicated by the fact that this same purple discoloration takes place in pieces of glass which have been exposed for some time to the direct action of the rays outside of the walls of the tube.

That the molecular action above referred to results in a molecular rearrangement in the glass of the anterior hemisphere is a further proposition, which, while beyond absolute proof by any means at my command, is so strongly suggested as to at least be worthy of most careful consideration. This rearrangement, it seems to me, is somewhat similar to that occurring in steel which has been magnetized. Whether this consists of simply an alignment of the axis of the molecules in parallel with the normal direction of the discharge from the anode, this taking place slowly and progressively with the use of the tube, or whether it consists of some more complex action, that tends to a continuance of the original lines of force of that discharge, is a problem, the solution of which is outside my domain.

The lower the fusible point of the glass, the more susceptible it is to the action which results in the discoloration.

The fluorescence in the tube composed of glass of a high melting point is of a brighter and more greenish hue than that occurring in glass of a low melting point, while glass of an exceedingly low melting point fluoresces blue. The variety of results thus obtained being apapparently due either to difference in the chemical composition, or the molecular construction of the different glasses composing the respective tubes, or both.

The glass of the anterior hemisphere of the tube, exposed as it is to the action of the direct discharge from the anode, becomes, as already stated, more brittle than the glass of the posterior hemisphere. In the case of a seasoned tube becoming punctured in its anterior hemis-

phere the part of the glass immediately surrounding the puncture, after being subject to a degree of heat necessary to the process of repair, is apparently restored to the condition of the glass in a new tube, and resumes all the characteristics thereof; the color disappears, it fluoresces a bright greenish-yellow, and probably is less brittle.

All these facts, it seems to me, tend to verify the theory that some change takes place in the molecular formation of the glass which, as it progresses, permits the free passage of a continually increasing volume of the direct rays or the inability of the glass to generate indirect rays. When this change becomes practically completed, as in a seasoned tube, we are able, all other conditions being equal, to secure a very large proportion of direct rays.

Hitherto a skiagraph lacking in contrast, but with marked density in all parts. has been considered as due to a high degree of penetration. Considering, however, the nature of these indirect rays, and the fact of their ability to set up secondary rays in all objects with which they come in contact in the surrounding atmosphere, and especially in the soft parts of the tissue which they encounter. it can be readily understood that they thus reach the plate from all directions, projecting themselves at various angles beneath the subject behind the bones or other substances, causing thereby an entire lack of definition of all parts and an obliteration of detail in the soft parts We are thus forced into a recognition of their baneful efforts, and of the fact that to them, rather than to the degree of penetration, is due the imperfections above noted.

On the other hand, the direct rays, reaching the plate as they do in established lines from a fixed or ascertainable point. and being absorbed by the tissues interposed, presumably in proportion to the amount of solids contained therein, give a clear outline and perfect detail, even of the softer tissues and with a preponderance of these rays we are able to show not only the bones and muscles, but the kidney, and spleen, and walls of the intestines, and the arteries, and in one case which I have recently made, even the blood with the veins, showing the anastimosis around the knee and elbow.

The indirect rays are caused by the deflected cathode stream that has not been converted into X-rays at the focal point of the anticathode. but are carried along with the direct rays until they strike the wall of the tube and

are there converted into what I termed indirect rays.

First. As originally illustrated by Roentgen the cathode stream caused a brilliant yellow fluorescence of the glass when focussed directly on it.

Second. Prof. J. J. Thomson describes an experiment in which he shows that all cathode stream is not converted into X-ray at the focal point, but that some of it is deflected.

Third. The cathode stream causes great heat when focussed on glass That part of the tube behind the target is not heated to the same degree and does not fluoresce like that part exposed to direct X-rays and the deflected cathode stream.

Fourth. The similarity of the point T in Fig. 3, where the cathode rays strike the wall of the tube. and the disc F were the things that led me to this line of investigation. The X-ray either direct or indirect does not generate any heat in passing through the glass. Therefore, the heat of the glass tube is not caused by the X-ray generated at the focal point of the anode, and is not caused by the heat radiated from the anode, because the posterior hemisphere is colder than the anterior.

Fifth. In a tube so constructed that a piece of thin aluminum, mica or glass shields some part of the anterior hemisphere from the focal point of the anode, that part of the glass so shielded does not become hot, does not fluoresce, and does not give off indirect rays. Heat is only generated where the cathode stream, either direct or deflected, is converted into X-ray.

In a low vacuum tube more of the cathode stream is converted into X-ray at the focal point of the anode than in a high vacuum tube. and in a very high tube the cathode stream deflected from the anode is not converted into X-ray at the wall of the tube, but is again reflected to some other part of the tube.

Glass exposed to the direct rays and the cathode stream direct. or the deflected. undergoes the molecular activity and change described in this paper, and does not generate the amount of indirect rays that new glass does. The thinner the glass the less indirect rays generated. A coil and interrupter so constructed as to generate a current of very high voltage with low amperage will cause more of the cathode stream to be deflected than one with lower voltage and lighter amperage. The tuning of the apparatus is, I believe, the regulation of it so that the greatest amount of the cathode stream is driven at the same velocity.

A tube so constructed as to cut off all the deflected cathode stream is the first thing to think of. But the ideal is a coil and interrupter and tube so constructed that the entire cathode stream will be converted into X-ray at the focal point of the anode.

The direct rays are generated at the focal point of the anode by the impact of the cathode stream, from which point they pass in all directions in front of the anode and are absorbed by the tissues interposed presumably in proportion to the amount of physiological solids they contain, giving clear-cut, well-defined shadows even of the very soft tissues. Some secondary rays are generated by the direct rays.

The indirect rays are generated at the wall of the tube by the deflected cathode stream which has not been converted into X-ray at the focal point of the anode but are carried along with the direct X-rays to the wall of the entire anterior hemisphere, where they are converted into indirect rays. These indirect rays pass in all directions from the wall of the tube, behind the target as well as in front, and owing to the large area of the source of origin and the secondary rays generated in the soft parts they cause a blurring of the outlines of the bones and soft parts. The secondary rays are caused as much or more by the indirect rays than they are by the direct rays.

A tube so constructed that none of the deflected cathode stream can strike the walls of the tube will not fluoresce and will not generate indirect rays. But the ideal is to have a tube, interrupter and coil so constructed that the entire cathode stream will be converted into X-ray at the focal point and that X-ray will be purely direct ray.

DISCUSSION OF DR. COLE'S PAPER.

DR. DUNHAM, Cincinnati:—The fact that there are several varieties of rays with which we must deal in taking a picture is true, and this fact has been beautifully demonstrated by Dr. Cole's experiments, but if the doctor intends to say that these facts are new and original I differ with him.

We have X-rays coming direct from the target, due to the impact of the cathode stream on the anode—the direct rays.

Second, we have the rays from the surface of the tube due to the impact of either the stray cathode particles, as I understand Dr. Cole to believe, or due to the X-rays passing through the glass wall. The rays which start in all directions from the tube surface have had many names given to them, one of which is the glass rays.

Third, we have the rays which are produced entirely outside of the tube by the X-rays striking some form of matter, even being

produced as Roentgen proved by striking the air. These Dr. Cole termed the secondary rays.

Every one of these facts are clearly and scientifically dealt with in Roentgen's third paper. In this paper there can be no doubt of his meaning, for here he was dealing with a focus tube.

The only new fact which Dr. Cole has affirmed is that the glass rays are produced by stray cathode rays striking the glass and not by the X-rays striking the glass.

The construction of the compression diaphragm was based upon the necessity of eliminating these foreign rays and their existence was beautifully illustrated by diagram. Many besides Albers-Schoenberg have written on this subject.

It may be that I have misunderstood the doctor's attitude, and he will explain in what way his conclusion differs from those of others previously expressed.

DISCUSSION ON DR. COLE'S PAPER.

DR. WELLS, St. Louis.:—I wish to support the essayist. No man can work over things in his own way without adding to the sum total of knowledge. Dr. Cole certainly has done original things and so far as I am concerned his subject is more appreciable to me now than before hearing him.

I want to mention in connection with the secondary ray a phenomenon that has disturbed me long, one that I have noticed for several years and have been unable to explain. I refer to the mottling spotting of the plate which is sometimes observed after development. I have just spoken to one member about it and he regards it as an imperfection of the plate. I believe that that is the concensus of opinion among X-ray workers. This mottling or spotting occurs usually in the part of the plate that is uncovered and merges over into the part that is covered by the object being radiographed.

It occurred to me just recently that it was due to something peculiar to the X-ray, for the reason that I had never seen it in a plate which had been developed after exposure to ordinary light, nor in one that had been over-exposed to ordinary light. I accordingly made an experimental exposure of an 8x10 plate in four sections. The first quarter of the plate I gave what I thought to be a normal exposure to get a maximum degree of reduction in development. To the second quarter I gave what I thought would be a partial over-exposure; to the third a little more, and to the fourth I gave a long over-exposure. My results coincided with what I expected. In the first quarter I got a typical complete reduction; in the second a great deal of the mottling; in the third the condition was more of a uniform haze, and in the fourth a complete solarization, or over-exposure, of the film took place. That, to my mind, is complete proof that the mottling is due to varying degrees of over-exposure of the sensitive film.

The explanation of the phenomenon is, I believe, that the shaft of light is complex, consisting of the direct and indirect ray, the former having greater actinic activity than the latter. This gives the varying degrees of reduction on the plate.

Until I find some more tenable explanation, I shall accept this theory, and I believe that the experiment I made is fairly conclusive and can be repeated by any worker. By bromide restraint I believe you can prevent its occurrence. I am quite sure

you have all seen this phenomenon. It has occurred so often in my work that I am sure it is not a thing peculiar to my technique.

DISCUSSION ON DR. COLE'S PAPER.

DR. SINCLAIR TOUSEY, New York City:—I have made quite a number of experiments with the X-ray that have led me along a different path. With reference to the invention of an apparatus which I might call a registering ortho-diagraph: I use an ordinary ortho-diagraph, but have the tube completely enveloped in an opaque substance. Instead of making the mark with a pencil, tracing the outline of the heart as I see it on the screen, I move the apparatus back and forth and produce a picture on a photographic plate which is backed up by lead, and the only ray which is allowed to reach the plate is a straight parallel line of X-rays which pass through the body. The effect is the same as when we take a quarter of a dollar, wrap it up in paper and then with the end of a lead pencil we press on the paper, rubbing the pencil back and forth. This makes marks on the paper which show the projections of the coin and gives you a good representation of it. We have covering the necessary area an infinite number of very small pictures that overlap, and thus we get an actual image of the heart on the plate.

DR. COLE, closing the discussion:—Regarding what Dr. Dunham said, I wish to say that I have read Roentgen's work very carefully but I fail to find any mention made of this. He spoke of the direct ray, of the cathode stream causing the fluorescence of the glass when it was focussed directly on the glass but he does not speak of the cathode stream being deflected from the focal point of the anode, and causing the fluorescence of the anterior hemisphere.

The diagrams I have seen all show energy generated at the focal point, and that for some reason the rays which emulate at right angles to the face of the plane of the anode or near that were spoken of as direct rays, and those which come off at a greater angle were spoken of as a more or less indirect ray.

I may be mistaken about that or there may be some diagrams that I have not seen, but no one who has seen these diagrams that I showed you, with the rays generated at the wall of the glass has told me that that has been shown before. And no one has shown me that these rays were caused by a deflected cathode stream. There may be something in the German literature that I have missed, but some of those who have seen my paper , before surely would have known of this.

As how it is possible to produce the greatest amount of direct rays- in an article published in the Archives of Roentgen Rays, May 1905, I mentioned:- First, the use of old tubes. For some reason the glass in old tubes becomes dead, as Roentgen called it, and they do not fluoresce as brightly as new tubes and therefore do not produce as many indirect rays, while as many or more direct rays are produced at the focal point of the anode. If you heat the glass it will assume its original texture and produce as many indirect rays as new glass. Therefore use old tubes.

Second, a unison between a tube, coil and interrupter described in the same article produces less indirect rays.

Third, a screen of glass, aluminum or some substance near the anode to prevent the deflected cathode stream striking the glass and producing indirect rays, may prove successful.

Fourth, the use of the compression blend or diaphragm to ctu off the indirect ray, is also practical. But the ideal thing is to produce a coil, tube and interrupter so that the entire cathode stream will be converted into X-Rays at the focal point of the anode.

ROENTGEN RAYS IN THE TREATMENT OF LUPUS VULGARIS.

H. W. Van Allen, M. D., Springfield, Mass.

In presenting this important subject to you I shall endeavor to be as concise as possible. speaking from the standpoint of the radiologist rather than that of the dermatologist.

I will strive to demonstrate two distinct methods of treatment, each applicable to a certain condition of the disease and not to another.

The inability to effect a cure when the one method, which for certain forms of the disease would be correct, is used upon another form is, I believe, the cause of some reported failure.

Freund reported cases treated in 1897 with success, and in 1900 P. M. Jones, of California, reported very fully his work along this line.

Thus we see the length of time the X-ray has been used in this disease is considerable, and it should have been placed upon an established technique. The diagnosis in my cases rested upon microscopical findings in more than half the cases. and in the remainder upon the opinion of capable dermatologists.

These cases usually run over such a long period, and have seen so many physicians, that they present themselves with a ready made diagnosis, which only needs to be confirmed.

Another class of cases showing both signs of Lupus and Epithelioma can be diagnosticated by the reaction under the X-ray.

Let us first turn to the Pathology of Lupus. and I hope to demonstrate from this as a basis the rationale of the appended treatment.

Hyde and Montgomery state that the "essential lesion in all forms of cutaneous tuberculosis is the nodule of granulation tissue containing small round cells, larger epitheloid cells, and giant cells, having a homogeneous center, and few or many large vesicular nuclei situated for the most part along the border of the cell. Around and between these cellular elements is woven a network

of connective tissue bundles." And here follows a significant fact: although there is marked proliferation of the endothelium of the vessels, no new vessels are formed, the old ones becoming obliterated, and there results a necrosis or cheesy degeneration of both cells and intercellular substance. Tubercle-bacilli are less numerous in Lupus Vulgaris than in any other tubercular skin lesion, but are always present in the nodule and are predisposed to the giant cell.

The above-named authors further state this important fact, that in Lupus, more than in any other form of cutaneous tuberculosis, the proliferation of cells leads to a constructive or regenerative process, as a result of which the lupus nodule may be replaced by scar tissue, or there may be an excessive formation of new connective tissues producing the various degrees of elephantiasis so often seen in Lupus.

Involution of the lupus tissue is accomplished by (1) reabsorption of the tissue, (2) by fibrous metamorphosis, (3) and by ulceration. When fibrous metamorphosis takes place a mass of connective scar tissue takes the place formerly occupied by the lupus growth.

I have had a number of microscopical examinations made of lupoid tissue after the diseased area had been subjected to X-ray treatment for some time and the findings seemed to agree very closely with those of Heuter, who, as far back as 1900, stated that the primitive lupus tissue underwent a transformation into fibrous tissue, only a few groups of tubercular cells remaining. The giant cells were very numerous and were most marked at the margin of the nodule, where they were seen in great masses, almost or quite displacing the leucocytes which normally surround the tubercular focus. This arrangement of cell elements allows the greatly increased connective tissue to immediately and closely surround the nodule. It makes a well-defined limit to the tubercle. No tubercle-bacilli could be found in any case after an extended course of treatment. Dr. Grouven, who has made valuable research in the field, says about the same thing. He is struck by the abundant connective tissue which encapsulates the several tubercular foci in the form of thick bundles of fiber penetrating more or less freely the interior of the foci themselves. Thus the remainder of the nucleus is enveloped by a closely woven network of connective tissue. The spindle cells, which are present in great numbers, also suggest the active proliferation of connective tissue.

I cannot refrain from quoting a little from the report of Doutrelepont, in which he says of a section from a case ofter ten weeks' treatment, "that the tubercle is seen to be surrounded by a mass of leucocytes, and is replaced almost entirely by connective tissue containing a few lupoid cells, with an occasional giant cell." He claims that the cure by the use of the X-ray seems to be as follows: The hyperaemia set up by the X-rays provokes an abundant migration of leucocytes from the vessels. This action takes place first at the edge of the tubercular nodule and penetrates by little projections into the substance of the nodule, being in time changed into fusiform cells and fibrous connective tissue. The presence of these fusiform cells bears witness to the active formation of the connective tissue.

These few remarks on the fine anatomy of the parts, both when nature is attempting a repair alone, or when the X-ray has been used, give us a clue to a rational treatment, which I hope will meet with the Society's approval.

Cases presenting themselves for treatment readily divide themselves into two classes in regard to size—the small pea-sized lesion with a single nodule and a surrounding zone of infiltration, and the more extensive disease with numerous nodules and more or less unhealthy intervening skin.

We will speak of the latter first—remembering that nature's first effort in repair, as demonstrated above in these cases, unaided, is to produce connective tissue and, as it were, crowd out the unhealthy deposit, she first sends from the blood vessels in the parts a large number of leucocytes. We can cause just this to occur with the X-ray—a mild degree of radiation with a medium tube causes fatty degeneration in the blood vessels near the surface, and the leucocytes pour forth into the tissues and later fibrous connective tissue takes its place. This step being accomplished, we must wait until the skin recovers nearly a normal appearance Now we have nodules alone to care for, the skin being simple, non-infected scar tissue. Again, turning to nature, what does she do with these tubercular foci? Causes them to slough out. Just so with the X-ray.

Protecting the new made connective tissue the ray is applied only to the nodules—here, as in the first class of cases where there is a single small infection, this ray must be applied in large and repeated doses, with a low action tube, until necrosis will follow, but not until it

actually occurs. All this being accomplished, we have a healthy scar surface, and small non-tubercular simple ulcers. which heal rather slowly, but seem to be, when healed, permanent.

This is the plan which may be varied in the details at the will of the operator but with very pleasing success I have found.

I will take a little more of your ime to give the details of my technique: As a generator I use a 12 glass plate static, 32 inches, run at about 400 revolutions per minute. This gives a high voltage, low amperage current of good volume. Tube, the ordinary American made. German type, with a heavy platinum anode. I believe other metals or platinum plated targets are not as effective.

For the treatment of the general surface the tube backs up an air spark gap of from one to two inches, distance from the anode to the skin about ten inches, and the treatment ten minutes in duration. Application being made twice per week until the first idea of hyperaemia can be obtained—this averages about a month or less, then the treatments are given once a week for about a month longer. After this the patient is told to come back in a month, when usually the surface is of a pinkish, healthy color, and nodules can be clearly made out. At times several have been brought to the surface which were not visible before. Now protecting the intervening tissue the nodules are alone treated with a tube having less than an inch, and less than a half-inch is better, air spark gap. Anode six inches from surface. the treatment being twelve minutes long, and made three times per week. until a very decided reaction takes place, which, when the cumulative effect of the treatment occurs, produces scabbing and slight ulceration. As soon as the active cauteral action commences to subside I have found the high frequency discharge, given off from a low vacuum tube. excited by a Tesla coil and resonator attached to the static machine. to be of great value in hastening the repair of the cicatrication.

A word as to the protection of the patient: I have tried various methods but none seem as good as thin sheet lead, about like thick tea lead. This I have backed up with cloth stitched around the edge, to prevent from brush discharge, and holes are cut through—first. for the whole surface, and bound with adhesive plaster, making a permanent shield. which will last and remain perfect all through the treatment; for the second part of

the treatment, a smaller sheet of lead is taken and individual holes are cut for each nodule. This shield is held exactly in position by two or three narrow strips of adhesive plaster, which project over the edge and adhere to the skin; over this is laid the first or large shield, to protect the surrounding parts.

The patient I usually have in the recumbent position, as in this way they are the most comfortable and less apt to move, which changes the target distance. It also allows the shield to be without any support, as in the case of the face a band around the head.

A word in regard to the usefulness of the X-ray treatment in comparison with the two other methods practiced. The surgical method, either by the knife or curette, is painful and leaves frequent scars. The percentage of returns is large, as the infection often extends much farther than is apparent at the time of operation.

However, worse than this is the danger of infection to the adjacent, or even more distant parts from the open blood vessels and lymphatics.

The other method, that of Finsen, is a competent rival of the X-ray treatment, but it has some very serious objections. The treatment extends over a long period, sometimes years, at frequent intervals, now and then as often as twice daily—each sitting being, at times, an hour in length—so that the total time under actual treatment is many times that which is required by the X-ray. During all this time a competent attendant must be actually with the case.

The best results from the Finsen treatment are obtained by the direct solar rays and so this method is dependent, somewhat, upon weather conditions. A very serious drawback with the Finsen ray is the limited area that can be treated at a sitting, making multiple treatment necessary, and again increasing the time to cure—there is also danger of reinfection from the uncured part before the whole area can be treated.

Now as to actual results: I have appended a tabulated summary of fifteen selected cases treated by me in the last four years. These cases were selected, not because of the good results, but because of the certainty of the diagnosis. Many, as you will see, were diagnosticated by the microscope, while all those in which the diagnosis was made by clinical evidence had been treated by competent specialists for Lupus, or referred by them to me with the diagnosis so made. In the results given, those marked cured the tissue has every appearance of health,

with not the slightest evidence of a return. The skin is smooth, and time enough has elapsed since treatment to assume the cure is permanent. Those marked apparently cured, there is no evidence of Lupoid tissue, but the skin is still a little rough and not as good as in the former class.

This gives an average time of treatment of six months, which, if case 4 was taken out, would be reduced to five months. This case came from a distance and due to poor general health was very irregular in attendance, sometimes being absent for several months.

The average time since treatment was discontinued is over one year and eight months. This seems to be long enongh to make the results probably permanent.

The percentage of cures is 80 per cent, or if case 12 is taken out, 87 per cent. This case I treated, by error, for epithelioma and now the growth, which is small, and in all probability curable when the proper method is applied, is returning. If only the ones with smooth skin are regarded cured, the percentage falls to 75 per cent, which I still consider very good.

THE ULTIMATE RESULT OF THE ROENTGEN TREATMENT OF CARCINOMA OF THE BREAST.

By George C. Johnston, M. D., 611 Fulton Building, Pittsburg, Pa.

A review of the literature of the Carcinoma of the Breast during the last year reveals but little from the pens of those operators whose experience in the use of the Roentgen Ray is great enough to entitle their utterances to respect and attention. On the other hand a number of articles have appeared in the various journals which betray upon their face ignorance and inexperience. One of these writes, after relating a deplorable series of surgical mishaps arising during an attempt to operate upon a breast which had been previously rayed by another operator, accused this preliminary treatment of a number of unpleasant things and ends with a denial of the ability of the ray to produce any tissue changes whatever beyond a dermatitis, basing these sweeping assertions upon an extended experience of six cases. Such articles as this, which is merely an example of a number of others to which my attention has been drawn during the year, are not entirely worthless, since they serve to produce a thrill of amusement and compassion in the minds of those who have sufficient experience to enable them to correctly judge of the value or otherwise of this agent in the treatment of the condition noted, but unfortunately the wide-spread dissemination given such misleading statements by the various journals is liable to lead to a misapprehension upon the part of the profession at large who have but little time to investigate such matters and are apt to lend most attention to the loudest noise. In one such article a technique was employed for deep-seated carcinoma which was exactly suited for the treatment of lupus or superficial epithelioma and diametrically opposed to those principles enunciated repeatedly by the men who have announced certain degrees of success in the treatment of deep-seated carcinoma, primary or recurrent.

The author, in apparent ignorance of the fact that the X-ray possesses no power of independent judgment, after using a ray which is absorbed by the skin, boldly states that from his extensive experience of six cases he has proven that the radiation from an excited Crookes Tube produces superficial effects only and is incapable

of effecting tissue changes at a depth greater than one-quarter inch below the surface.

I do not believe that any false modesty should be allowed to prevent the challenging and direct controversion of such palpable misstatements. It has been repeatedly demonstrated that a capable apparatus in the hands of a competent operator can be made to produce radiations so penetrating that they may be absorbed and rendered effective therapeutically at any depth in the body, in fact the skin of the back may be affected even to the production of a marked dermatitis by radiation directed toward the front of the chest, thus passing entirely through the body. I do not know of any way by which those members of the profession may be taught who persistently ignore and disregard the repeated statements of those physicians who have devoted years to this work and have freely formulated and disseminated exact and explicit directions whereby any other physician of intelligence can reproduce their technique. There are none as blind as those who will not see, and the only defense seems to be the exposure of the dangerous ignorance of such writers who make up for a paucity of ideas with a deluge of words and who base sweeping generalities on individual observations.

The power of the X-ray to affect distinct cellular change upon normal or pathological tissue is in evidence this year as it was last, with the difference that in the hands of qualified men these effects are produced with a certainty, directness and ease which is the natural result of another year's observation and experience. At the meeting of this Society one year ago, I made the strongest plea in my power for the wider adoption of ante and post-operative treatment of carcinoma. The ensuing year has not convinced me of the error of the position then taken, but has only served to strengthen it, and to more firmly ground the conviction that in such ante and post-operative treatment in conjunction with bold and skillful surgery lies the salvation of this class of patients. During the year some disappointments have appeared. Some cases are to be recorded as ultimate failures inasmuch as deep-seated internal recurrence has manifested itself and will probably progress to a fatal termination. Each of these two cases, however, were suffering from recurrent inoperable carcinoma which under the influence of the ray alone disappeared completely, giving the patient over three years of health and happiness. While it is necessary to class these cases as ultimate failures, yet

I think that the results obtained more than compensated both physician and patient for the trouble of taking a few painless treatments. A number of other similar cases have shown no tendency to recurrence. Neither of the cases which recurred were subjected to anti-operative treatment. In both post-operative radiation was only begun when the appearance of marked recurrence forced the adoption of some method of treatment, whereupon the surgeons announced their inability to confer any further benefit by operative procedure. If the X-ray is to be employed in a manner to cast credit upon it as an aid in the treatment of this class of cases, anti-operative ardiation must be insisted upon, but if refused post-operative radiation must be begun coincident with the beginning of recurrence at the latest, and should be employed, where the surgeon will consent, before recurrence has manifested itself, preferable the tenth day after the operation. In every such case the mediastinum as well as the site of operation must be raved.

In no case of primary carcinoma submitted to radiation without operation has recurrence manifested itself, but it must be remembered that in every such case the primary growth had advanced so little that the patient was unwilling to admit the necessity of operation. I am unwilling to believe that the satisfactory result in these cases was due to the absence of operative procedure, but attribute it to the primary nature of the growth and the absence of metastasis at the time of the institution of the Roentgen treatment.

During the year repeated and renewed evidence has appeared of the actual value of the ray in producing retrograde changes in carcinomatous tissue. The adoption of the method of filtration, founded upon principles established by Roentgen and Walter and applied first as a therapeutic aid by Pfahler, of Philadelphia, and value proven clinically and experimentally, has resulted in simplifying the technique and permitting the administration of much heavier doses with consequent increase in the quickness of response of the disease to the ray. The experience of the past year has been thoroughly satisfactory.

The incredulity and antagonism of certain members of the profession in spite of the misleading contradicting reports circulated by the class of observers referred to above has shown a marked decrease. The profession in general are manifesting a healthy interest in the possibilities of Roentgen Therapy and are beginning to ask intel-

ligent questions, thereby making the opportunity for explanation and conviction. It should be the duty during the next year of every Roentgenologist to perfect himself in the technique of the treatment of carcinoma; to satisfy himself as to the exact value to be given the method as practiced by himself. Extreme conservatism combined with healthy investigation and repeated observation is necessary in order that we may arrive at a true determination of the exact value of this agent in this disease.

Primary carcinoma of the breast should be treated by the ray alone when the condition or age of the patient presents a strong argument against preliminary operation. The inherent fear of surgery which so many of these patients present must not be permitted to act upon our sympathies or bias our judgment, but the treatment of primary cases must only be undertaken for good and sufficient reasons.

Free discussion of these problems with the surgeon where the Roentgenologist shows his freedom from prejudice are usually productive of good, since when the surgeons become convinced of the actual value of the ray in preventing or retarding metastasis they will insist that their operation be aided by such profilactic measure.

Bold assertions of the ability of the ray to cure carcinoma wherever situated without recourse to surgery carry not conviction but contempt to the majority of the hearers, and it must be remembered that an assertion of fact and a demonstration of fact are two widely different things.

While the writer is daily more convinced of the actual assistance which the ray is capable of affording in the treatment of carcinoma he is also more than ever certain that extreme conservatism of statement combined with practical demonstration of actual result is the best way to convince the profession of the ultimate value of radiotherapy intelligently administered as an aid to surgery, not a substitute in the treatment of carcinoma.

Conclusions:

1. Results are better and more permanent the earlier treatment is instituted.

2. The value of post-operative radiation has become more and more apparent.

3. Mediasteinal recurrence, while grave, is not a death warrant.

4. Technique is not an accomplishment, but an absolute necessity.

5. No tube is too good to use for treatment.

6. Filters are a necessity in the treatment of cancer of the breast.

7. Treat no case that you know can be cured surgically.

GENERAL OBSERVATIONS OF DIFFERENT WRITERS AS TO THE EFFECTS OF THE X-RAYS UPON HAIR AND OTHER TISSUE ELEMENTS.

By Wm. S. Newcomet, M. D., Philadelphia, Pa.

While undertaking to review this subject, it would be well to preface this article by the fact that it is not strictly from a dermatologic standpoint, although it does invade rather freely, and in apology it might be said here that there is no field in medicine which is so broad as is ours, for it practically interlinks all the special branches of medicine.

One of the very first observations made as to the effect of the Roentgen Ray upon tissues was in regard to the loss of hair that often followed its use, and as several well-known writers and experimenters aspire to priority, it must be admitted, no doubt, that it was made simultaneously by many, although at that time it was not deemed worthy of record. Yet at the same time that the subject is an important one is well emphasized by the statement of Sabouraud, where he estimates a saving of 1,500,000 francs a year in the department de l'assistance brought about by the rapid and efficient relief in cases of ringworm only. This fact, coming from such a source, shows plainly that if these rays are properly handled they will be of use to the dermatologist as a method for the rapid and painless removal of hair in such cases where the cure of the disease demands this treatment.

At the present time our knowledge as to the effect of the X-ray upon all tissue is rather confused, but from the mass of testimony some facts seem to predominate, the one that concerns this subject most is that it evidently has a selective tendency for the epithelial elements and it would appear that the hair seems to be the most susceptible. Some have stated that the higher the epithelial structures are specialized the more susceptible they are to the ray, but this can hardly be true, for more than one observer has called attention to the resistance

of the widely different and highly specialized structures in the eye. Others have stated that it is due to blood supply of the part, but this is also open to many objections. Under all conditions of inflammation the epithelial structures are first to suffer, and if scar tissue results fibrous tissue usually replaces it, at the same time fibrous tissue is last to give way in an inflammatory process. All that can be said is that the ray has a selective tendency for certain cells. This fact is brought out clinically, but so far we have very little evidence from a microscopic standpoint that will aid us toward determining the exact status of this point.

Pusey in his book has summarized the effects of the X-ray as follows:

1. The X-ray influences especially or exclusively the cellular elements of the skin. These are influenced primarily and undergo a slow degeneration, while the connective tissue elements, the elastic tissue masculature and cartilage are changed only to a slight degree, and suffer only secondarily, as a result of the cellular degeneration, and the inflammatory reaction consequent to it.

2. The degeneration affects the epithelial cells in the highest degree and to a less extent the cells of the glands, the vessels, the muscular tissue and the connective tissue.

3. The degenerative appearances are of various kinds and affects both the protoplasm and neuclei.

4. As soon as the degeneration has reached a certain point an inflammatory reaction appears which manifests itself with gathering leucocytes and marked emigration of the blood corpuscles, when greater cell degeneration occurs, as a result of stronger exposure.

5. The changes in the large and small vessels are apparently of great importance, as affects the further development and slow healing of the ulcerations.

These conclusions in no way explain the many widely different observations that have been reoorted in regard to the effects of these rays upon the hair. Clinically we know the hair can be removed, but how this is accomplished is still unknown, as we have absolutely no distinct pathologic degeneration which we can ascribe alone to the X-ray. Another fact that we know from a clinical standpoint, and can be stated with a degree of certainty, is, if too much X-ray has not been given to the part, that after the hair has been removed, in certain length of time. the growth of hair will recur and literally no change can be noted in its appearance; but here comes in the

factor of the variability of the dosage and in consequence a change in the future growth. Cases have been reported where the loss of hair was permanent or in some instances a slight loss in amount; gray hair has been restored to its original color, in some cases there has been a change of structure, as thin hair has come in coarse, or straight hair has afterward been curly or kinked; again there has been an increase in the amount of hair, and even in cases of baldness at the advanced age of 80 years.

Now when we consider that the range of power of this agent is from a complete removal of all hair on a spot where it is growing, to the growing of hair on a spot where it has been absent, it can easily be seen just how confused the whole subject must be, but the problem depends upon two points. First, the application of a very mild X-ray usually acts as a stimulant to the hair cell, while secondly, strong currents destroy them, the amount of permanent damage depending wholly upon the amount of injury to the cell elements inflicted by the burn.

If these two rules are correct, then it would seem that it was an easy matter to either grow or remove hair, just as the occasion required, but while these two primary rules may be correct in theory, the application is an entirely different matter. Here we have to contend with two important factors upon which we can never depend for constancy. First, the variation of the quantity and quality of the X-ray, although to a great extent this can be controlled; while secondly, the personal idiosyncrasy of the patient. At the same time different localities on the same person must be considered Dalous and Lassere contend that certain forms of epithelium are more sensitive to the X-ray than others; for instance, the squamous epithelium resist the X-ray to a greater extent than the columnar type, and while this may explain to some extent the resistance of different tumors, it does not, however, account for that most annoying and widely different variability of the personal equation.

Various methods for measuring the amount of X-ray that a given patient receives have been recommended to overcome this difficulty, and taking it for granted that the physical part of this idea is correct, we have not advanced one point toward its solution. Therefore in all our cases we must proceed with care, otherwise unexpected and undesired results will be likely to follow. The method of obtaining the desired result

in one treatment, as is recommended by some, should be condemned as dangerous, and while the administration of the X-ray is slow and often tedious if one has many cases he may treat several at the same time, either by using a number of tubes or else by a screen, seating four cases at one sitting. This not only saves the operator's time, but is a decided point in economy. The only point to be observed is the proper selection of cases, although this can be modified by placing leather over the window of the screen.

In treating the class of cases under consideration a fairly low tube should be used, as very little penetration is needed, and to obtain the desired result simply vary the time of exposures. Here we may divide our cases into three groups: First, those where the desire is to promote the growth of hair, as in alopecia. Second, where only a temporary loss of hair is desired, as in sycosis, favus, etc. Third, where the desire is for a permanent loss, as in hypertrichosis.

In the first group of cases great care must be observed not to give too much X-ray, as only the slightest stimulation is to be desired. Upon the appearance of the slightest erythema the treatment should be stopped and not commenced again for a month or more after the subsidence of all symptoms. In most cases of alopecia short treatments of one or two minutes from a rather weak tube given about once or twice a week will accomplish the desired result. This mode of treating these cases has not met with the general approval of most dermatologists, and as many believe that the majority of cases of alopecia recover in time, they do not approve of a method attended with so much risk.

In the second group of cases we wish to remove all hair temporarily. This must be done thoroughly, otherwise the result will be a dire failure, and in these cases it is better to carry the treatment too far than not far enough. While the hair usually falls easily, there is very little chance of its complete destruction, if as stated the slow method is employed. Bad burns are those that have been caused by a few heavy exposures; they ulcerate early and heal very slowly, often two or three years in duration, while those burns that result during X-ray treatment from an excess of the ray usually heal in a month or so and rarely give annoyance. Therefore, while it may show a great refinement in technique to be able to accomplish the removal of all the hair satisfactorily in one sitting, it must be admitted that it is attended

with some risk. The following cases serve to illustrate this point:

About two years ago a series of skiagraphs were made of the head of a young girl, 15 years of age. She was a blonde and rather anemic. Four exposures inside of a half hour; the time consumed during the taking of the pictures was about four minutes, equally divided between Muller and Fredlander tubes. They were energized by a 20-inch coil, 110 volts, electrolitic interrupter 20 amperes, spark gap resistance about 4 inches; anode was 18 inches from the plate, the surface of the head varied was the different positions. On the morning of the fifteenth day after the exposure the patient's mother started to comb her hair, when with the first stroke of the comb all the hair on the crown of the head was completely removed. No sensation was experienced by the patient. However, a month later this spot was covered by a fair growth of hair, arying from a quarter to a half-inch in length.

Case 2. A young man 24 years of age suffering from sycosis, parasitic, was given several treatments under the upper lip. After the last treatment there followed the most intense reaction, seeming almost to be erysipelas. About a month later after all symptoms had subsided, the X-ray was again applied with the same result. It was after the last series of treatments that he came under my care, and wishing to try this mode of treatment for myself, the good points were explained and so on, but the patient absolutely refused.

These cases illustrate the need of great care in handling the X-ray, and while it is in this class that the most brilliant results are to be expected.

The third class, where we desire the permanent loss of all hair, has not on the whole been satisfactory, although in some instances cases have been reported where the result was all that was to be desired, although in the average case the hair will recur except where there has been considerable destruction of the tissue elements, and this accident is one that should be avoided. In those instances where the hair does recur it is far better to treat several times or as often as required rather than produce a severe burn.

In conclusion it might be said that this field of the X-ray has hardly been considered in medicine, while the opportunities it offers for brilliant results are far better than many others, but when the operator does employ this agent he should above all other things be sure of

his diagnosis and then on the other hand be extremely careful not to allow the treatment to get beyond control. And the old adage "That poor results live long in memory, while the good ones are soon forgotten," is as true here as in any other place.

REPORT OF TUBERCULOUS ADENITIS TREATED WITH THE ROENTGEN RAYS.

By Russell H. Boggs, M. D., Pittsburg, Pa.

Case 1. Five years ago, when I began to treat the first case of tuberculous glands, by the Roentgen Rays, it was with the idea of checking the disease and giving the patient temporary relief. I was agreeably surprised to note a rapid improvement, and in three months the patient was apparently cured. Her family physician, Dr. R. J. McCready, has informed me, within the past month, that she is still in good condition and that there is no sign of recurrence.

This patient had been operated on six months before the case was referred to me. Prompt recurrence followed and the glands were breaking down when X-ray treatment was begun. This was my oldest case and shows how lasting these results may be.

Case 2. Mr. B., aged 23 years, had been advised to have the cervical glands removed, as they were rapidly increasing in size. Since the patient would not consent to an operation, I gave him four treatments of 20 minutes each with the tube placed at 12 inches, and a slight dermatitis occurred. Then the danger of an X-ray burn frightened him and he refused to take further treatment. This amount of radiation, however, checked the enlargement, and the glands are smaller and harder at present than they were four years ago when these treatments were given. This case is of interest as an early case in which dermatitis was produced in a few treatments and was followed by lasting results.

Case 3. Miss S., aged 18 years, referred by Dr. J. Shanor, had a tuberculous mass in the right side of the neck, and part of the cervical glands were breaking down. The patient had undergone an extensive operation nine months before X-ray treatment was begun. X-ray treatment was given three times a week for two months, at the end of which time the skin became so much inflamed that it was necessary to discontinue raying for three weeks. A series of 18 treatments was again given, and

when the second dermatitis cleared up, the greater portion of the mass had disappeared. That portion of the mass which was left was very hard but freely movable.

A consultation was held and she was advised to have the remaining portion excised. This she refused to have done. At present her condition is about the same as it was four years ago, when the last treatment was given. Although this patient is not absolutely cured, the result was very satisfactory, as the case was a desperate one. It is now three years and nine months since the last treatment was given.

Case 4. Mr. H., aged 19 years, had tuberculous glands of the right axilla. A diagnosis was made and the removal of the glands was advised by a surgeon. Seven treatments, of 20 minutes' duration, were given with a medium tube placed at 10 inches, which produced a marked dermatitis. This was followed by suppuration of the glands. Dr. McCready incised the suppurated glands, which apparently cured the patient. Three years and six months have elapsed with no sign of recurrenec.

Case 5. Mrs. W., aged 33 years, was referred by Dr. Maurer two years ago for X-ray treatment of a tuberculous mass about the size of a hen's egg, in the right axilla. The cervical glands were also slightly enlarged. When the patient came, the sputum was examined several times, and found to contain tubercle bacilli. The patient was treated three times a week for three months and then irregularly for two months longer, when the entire mass in the axilla disappeared. No tubercle bacilli were found in the sputum after three months' treatment. Up to the present time there has been no recurrence.

This case emphasizes the value of including the apices of the lungs in treating cervical glands.

Case 6. Miss M., aged 16 years, had lupus vulgaris of the right cheek, which had been cauterized a number of times. About six months before the patient was referred, the glands in the neck began to enlarge and several of them were as large as a hickory nut. This was the most obstinate case of tuberculous glands I have treated, and it was only after intense irradiation that the glands were reduced perceptibly in size. It is two years since the last treatment; the glands are normal, but there has been a recurrence of the lupus.

Case 7. Miss B., aged 38 years, had the cervical glands removed two years ago last April by a very complete operation, the line of incision extending from the

mastoid process to the clavicle. A recurrence followed two months later. Thirty-two treatments reduced the glands in size, made them very freely movable and very hard. The condition remained about the same until lately, when one of these hard nodules began to enlarge. It is a question whether it would not have been better to have had these hard nodules extirpated. One naturally assumes that a recurrence coming after such a long period of quiescence might have been prevented by removal of the walled-off foci that the hard nodules appear to contain. Removal without radiation, on the other hand, would probably have been followed, as in the first operation, by prompt recurrence. Possibly the treatment was not carried far enough. It is often difficult to decide when to discontinue treatment.

Case 8. Miss B., referred by Dr. McClelland, had been operated on, and as the recurrence was slight, 20 treatments caused a disappearance of the disease.

Case 9. Miss D., aged 21 years, was referred by Dr. Herron for tuberculous adenitis. After 35 treatments the inflamed glands disappeared, a single hard nodule remaining, which was freely movable. The patient remains in good condition after one year.

Case 10. Mr. H., referred by Dr. Nettleton, had been operated on for cervical adenitis, which later recurred. In the line of incision a keloid appeared. Thirty treatments apparently cured the glandular trouble and caused almost complete absorption of the keloid. At present the patient is apparently well and has returned to college.

Case 11. Miss M., aged 20 years, referred by Dr. Duff, had been operated on four times for tuberculous glands, and when she came for treatment, both cervical and axillary glands were involved. Twelve treatments were given in 1904. Then the patient left the city for three months, and while absent took a few X-ray treatments, which held the process in abeyance. When she returned, intense radiation, with the tube placed at 12 inches was given until a dermatitis was produced. Treatment was given in series for four months, when the patient was apparently well. Where the glands were of the largest size, there remained a small fibrous nodule. The patient is still in good condition.

Case 12. Mr. R., aged 25 years, referred by Dr. Cameron, had been treated by mild doses of the X-ray when the tuberculous glands were first noticed. Later the glands were removed, and afterward recurred. Three months of X-ray treatment caused a disappearance

of these glands. Nine months later the disease recurred and the patient was operated on last July, and as yet has not returned for post-operative treatment. The histological examination of these glands showed no tuberculous tissue remaining and led the surgeon to doubt the diagnosis.

Case 13. Miss B,. aged 18 years, underwent an extensive operation six months before coming for treatment, the line of incision extending from the mastoid to the clavicle. There were two masses, each about the size of a hen's egg. It was with difficulty that she could move her neck, and she was very much emaciated. After nine treatments she became more comfortable and began to improve in general health. The glands were greatly reduced in size. Sixty treatments were given in six months, when all the smaller glands had disappeared and the two larger masses were about the size of a hickory nut, hard and freely movable.. The treatment was then discontinued. It is now a year and a half and the patient has remained in good health until the last two months. After a long period of hard study and close confinement, she now appears to be developing pulmonary tuberculosis. although the nodules remain stationary. The patient in this case went into the country for a time, and when she returned she was greatly improved and is at present in good health.

Case 14. Miss G., aged 25 years, referred by Dr. Wertz, had tuberculous glands on the left side of the neck, and an operation had been advised. Irregular treatments were given from March to June, 1906, with considerable improvement. Then the patient discontinued treatment and expects to begin again this month.

Remarks.

Three other cases were treated, but only a few times. These were irresponsible and no later record of them can be procured.

In all the other treated cases a dermatitis was produced, and in most instances this was well marked. At present, by the use of filters, the same results can be obtained without producing much reaction of the skin.

A tube placed from 12 to 15 inches which reads "4" plainly on the Walter skiameter, with 1½ to 2 milliamperes of current passing through it, should be used in beginning the treatment of tuberculous glands. After the glands become smaller and harder, a tube which will read "5" on a Walter skiameter is better. A piece of

aluminum should be placed in front of the tube to filter out the softest, or derma, rays which are injurious to the skin and have no action on the glands. When possible, I believe it advisable to treat these cases daily, placing the tube at a greater distance from the skin.

The error in tube distance seems to be made very frequently and the reason is that it requires so much light to produce the desired effect with the tube placed at the proper distance. Many tubes will not maintain a uniform vacuum when $1\frac{1}{2}$ to 2 milliamperes are passing. With the tube placed at 12 inches from the skin, showing a penetration of "4" on a Walter skiameter, $1\frac{1}{2}$ milliamperes passing, and with an exposure of 20 minutes three times a week a mild erythema will be produced in from three to four weeks.

A review of these cases shows a remarkable predominance of mild dermatitides in cases in which permanent results have been obtained. This shows that the treatment must be energetic to be beneficial, and a mild dermatitis is not too much to pay for a successful result. The production of a dermatitis is however, a matter of much consequence, especially in the treatment of non-malignant disease, where cosmetic results are expected. A mild dermatitis is compatible with such a result, but a severe dermatitis must be guarded against. Equally good results, with less dermatitis, can be obtained by the employment of aluminum protecting screens.

In speaking of technique, it is only possible to give the average; technique must vary with the individual case and adapt itself to the necessity of the case if successful results are to be obtained. The guide to this variation must be the experience of the operator in the treatment of tuberculous glands.

The results obtained by the Roentgen Rays will compare favorably with those of any other method in the treatment of tuberculous glands, as a large number of the cases can be apparently if not permanently, cured. While it would be too much to state that permanent cures have been effected in any of the cases here reported it has been apparent that several of the cases have been seemingly cured, after a period of four years with no recurrence.

Improvement was not as a rule obtained until after at least 12 treatments, although there were some exceptions, one yielding after four, and others not until 25 to 30 treatments had been given. Permanent cures should

not be expected until after treatment for at least three months.

DISCUSSION ON PAPERS BY DRS. JOHNSTON, NEWCOMET, VAN ALLEN AND BOGGS.

DR. KENNON DUNHAM, Cincinnati, Ohio.:—I was very much interested in these papers because each of them presented something new. One thing that appeals to me particularly is Dr. Johnston's work on carcinoma of the breast. It has seemed to me that a most faulty procedure in operations for cancer of the breast was tightly closing the wound before the formation of granulation tissue. It would be much better to take the breast off, leave the wound wide open and then cover it with silver foil, thus leaving a large surface for irradiation. The granulation tissue probably would assist in preventing metastism. The procedure which we allow the surgeon to execute, removing the breast and then suturing the wound up tightly, and then raying, does not give us so much of a chance to do effective work, and thus gives the patient less of a chance to live. That is the reason why I devised the method of cutting out a good deal with electrolysis.

The practical point is, that I believe that in cancer of the breast, postoperative treatment would be much more valuable if we could get the surgeon to leave the wound open for irradiation, closing it later by skin grafts if necessary.

DISCUSSION ON THE PAPERS OF DRS. JOHNSTON, NEWCOMET, VAN ALLEN AND BOGGS.

DR. WILLIAM H. DIEFFENBACH, New York City.:—I wish to corroborate the temporary success attained by Dr. Gray in his case of malignant disease of the bladder, although the usual time will have to be awaited before the final results can be stated.

A case was referred to me by Dr. Burk Carleton, New York, one that had been diagnosed as a case of papilloma of the bladder. A suprapubic incision was made and as much of the growth was removed as possible. A pathologist subsequently diagnosed the tissue as a papilloma with commencing carcinomatous degeneration. The case was considered a hopeless one, as all of the tumor could not be removed, and it was suggested that the use of the Roentgen ray might prolong the patient's life.

I used a very hard tube and rayed the patient on and off for over five months, and a systematic cure resulted up to date. We should not consign these patients to death without attempting to do something for them. Although a metastasis may occur later, still that remains to be seen.

There is one thing that I have observed in the treatment of hypertrichosis which Dr. Newcomet did not mention, and that is, after persistent raying, we may get a fairly good cosmetic result, but very frequently we get a wrinkling of the skin, which may turn out to be worse than the original hypertrichosis. These patients have the appearance of constantly smiling and they look rather odd. This appearance is caused by the excessive amount of X-ray required for the treatment of hypertrichosis, causing an atrophy of the exposed tissues.

I have used in the treatment of both lupus vulgaris and tubercular adenitis a unipolar X-ray tube, which, I think, especially over small areas where it can be applied readily, gives us better results than does the ordinary X-ray tube. I would like to suggest that you employ this tube for some of the very small lesions which can be treated readily in that way. These mono-polar tubes can be energized from the Tesla, D'Arsonval or Oudin high frequency currents and in addition to the mild Roentgen ray gives off high frequency sparks which, in our opinion, assist in the resolution obtained in these cases.

DISCUSSION ON PAPERS OF DRS. JOHNSTON, NEWCOMET, VAN ALLEN AND BOGGS.

DR. GEORGE E. PFAHLER, Philadelphia.:—As to the treatment of tubercular adentitis. I have cases that have been well for several years. The results have been most encouraging. There is one class of patients with which we must be careful, where a gland is just about to break down. That gland should be excised first and emptied before beginning treatment, or the radiographer will get the credit of really having increased the disease rather than of causing it to disappear.

There is one case that has been referred to so many times indefinitely. It was referred to by Dr. McCollim yesterday and by Dr. Taylor in the Surgical Society in Philadelphia, where he reported the case. At the same time he reported a case of carcinoma of the breast treated by Dr. McCollim, he also reported a case of tubercular glands occurring in a child treated by me. There were unfortunately no X-ray men there to present the other side of the problem. That case came to me with a red tender spot over one of the glands. The child was a physician's daughter and he was very anxious not to have the child's neck scarred. I told him that I thought the gland would break down, but went on with the treatment, hoping that the gland would be absorbed. It did not become absorbed, but broke down and that led to this operation and the severe criticism of the preliminary treatment with the X-ray.

That case teaches much. If the tubercular gland had not broken down, or if we had opened that gland and then gone on with our treatments the case would have gotten well. The very statement that Dr. Taylor made that the lymph channels were obliterated. shows that the patient could have been cured and the child would have been saved the scarring of the neck. And that same argument applies to other lines of treatment. It is really an argument in favor of this treatment rather than against it.

DR. JOHNSTON, closing the discussion.:—In regard to tubercular adentitis. I have written more than I should have written on that subject. I enjoyed Dr. Boggs' paper very much. His conclusions, in my opinion, are correct. Dr. Pfahler's conclusions in regard to these cases which should be treated surgically, I believe to be correct. My experience has proven them to be correct. My experience in the treatment of tubercular adenitis with the Roentgen ray has been very satisfactory; I am treating more cases today than I did in the past three years. Several of the patients were physicians and they have been well satisfied with the results obtained. The others are mostly the immediate relatives of physicians.

There is at present no surgeon who can do a complete dissection of the deep cervical glands down as far as the mediastinum, and remove all the infected glands in a case of well marked, deep seated tubercular adenitis. An operation which does not remove every lymph gland and channel down as for as can be traced into the mediastinum is an incomplete operation. And an incomplete operation in any glandular trouble might just as well not have been performed at all, except when it is done for the removal of such glandular tissue as has progressed so far that suppuration is imminent, impending, and inevitable. Otherwise operation is absolutely contraindicated.

DR. NEWCOMET, closing the discussion on his part:—I think that many cases reported as cured have subsequently recurred. Where severe burns have been produced in cases of hypertrichosis, the results from the tissue changes are often worse than the presence of the hair.

THE ACTION OF THE ROENTGEN RAYS UPON THE NERVOUS SYSTEM.

By Prof. Carlo Colombo, Rome, Italy, Professor of Physical Therapeutics in the Royal University of Rome, Manager of the Central Institute of Physical Therapy.

Many radiologists, from the very first days of Roentgenology, have remarked the nervous disturbances occasioned by the radiations from the Crookes' tube, and they have attributed the cause of such phenomena—as of many others whose nature at the time was unknown—to most dissimilar agencies. Some traced them to the oscillating Herzian field that radiates from the Crookes' tube, especially when hard; others to the fluorescent cathodic rays that come through the walls of the tube; others to the specific action of the Roentgen Rays properly so-called; others, finally, to extraneous causes, as the uncomfortable position of the patient during the radiographic poses, which at that time were very long.

The phenomena were nausea, headaches, delirium at night, cramps, anaethesia, abortion and sometimes paresis and paralysis of the limbs occurring when patients had been long exposed to the X-rays.

Confronted with phenomena of such gravity, scientists sought an explanation from experiment, and many animals were sacrificed to this end. Rodet and Bertin Sans were able to provoke cramps, paralysis and death in 14 days, in the case of little animals exposed to the X-rays. Examining them after death they found meningo mizelitic alterations through all the regions of the

cord irradiated, also cellular hyperplasia and even some little hemorrhagic foci. This meningo mizelitis was certainly not of septic origin, because the bacteriological examination of the blood, of the cephalo-rachidian liquid and of the marrow gave a negative result.

Futassy has reported cases of paresis of the extremities, followed by death, in small Guinea pigs and rabbits that he had subjected to Roentgen irradiation. Oudin, Barthelemy, Darier and Ogus have also noted cases of paraplegia in small animals.

Kienbock found analogous phenomena in the case of rats, but he did not get the same results with Guinea pigs.

Scholtz, too, in one case, observed paralysis in a rabbit exposed to the X-rays. Ficinsky, in the case of Guinea pigs, found degeneration of the lateral cordons and of the gray substance of the posterior coruna of the cord. Finally Danysz found lesions of the nervous system in animals, not exposed to the Roentgen Rays, but to radioactive substances.

On the basis of these experiments new observations were made on human beings. Out of the large number of these I wish to refer to the following case of Bertoletti, which is very conclusive, as it has an analogy with the one I wish to report. It is the case of a man affected with ulcus rodeus of the right front-parietal region, who even before signs of cutaneous reaction appeared, was seized suddenly with violent headaches, nausea, vertigo, inequality of the pupil, and various symptoms of meningeal irritation, which passed away, but were repeated immediately upon the resumption of the radiotherapeutic treatment. Whence the writer concludes there was an active action of the X rays upon the nervous centre and upon the meninges, which was confirmed upon examination of the cephalo-rachidian liquid, on the subject of which the writer is specially qualified to judge. The active and immediate action of the Roentgen rays upon the nervous system being thus clearly proved, radiologists and doctors have attempted to utilize it beneficially in the cure of diseases of the nervous system.

The sedative action of the X rays on the pain principle seems undeniable. Neuralgias and neuritis have been relieved and even cured with irradiations from Crookes' tube, by Pusey, Cederholm, Guilleminot, Weit, Bloch, Leonard, Gramegna, and with radium by Darier.

But it would seem we may even count upon a therapeutic action on the nervous centres themselves.

At the Salpetriere Raymond says he cured two cases of syringo-mielia by irradiating the spinal marrow at the right place.

Pescarolo and Gramegna obtained the same result in two cases of syringo-mielia and in two intrarachidian tumors.

Branth claims to have succeeded in cases of epilepsy, Beck in Basedow's disease, Raymond and Zinimern in spinal tabes.

The case I am about to adduce will show once more, I think, the action of the Roentgen rays upon the central nervous system, though taking place in a way a little different from that hitherto observed by the various writers on the subject.

Mrs. A. T., 36 years old, of Massa Maritma, married, with three children. Nervous heritage in the family.

The patient shows all the stigmata of hysteria. As a young girl and a young woman she had frequent attacks of classic hysterical convulsions. Later on, although free from convulsive attacks, she was constantly in a state of some excitability of the nervous system.

On account of a sedentary life and bad abdominal circulation, a condition of marked varicosita of the lower limbs was developed, especially of the lower left leg. The member became dropsical, hard and covered with large brown spots, and from this, after her last confinement, there developed an acute phlebitis, with high fever and with alarming painful phenomena. This happened in 1900. When the acute phlebitis was cured, there remained hard varicose growths, both superficial and deep-seated, and both in the veinous and lymphatic systems, with infiltrations into all the tissues of the leg, cutaneous edema, pigmentation and serious muscular denutrition, so that the patient walked as little as possible.

In this way the evil went on increasing and great varicose ulcers were formed in the inner anterior region of the left leg.

The ulcerations were very painful, especially after medical treatment, of which she had attempted every variety in about five years; but the patient bore all her miseries with great resignation, and had no longer any hope as to the possibility of a cure.

All the same, following the advice of a surgeon, she agreed to have the varicose growths in different places

removed, after which she seemed for the time to be cured; but after a few months the varicose growths reformed both in the veins and in the lymphatics; the leg resumed its former appearance and a great ulcer formed on the inner front part of the left leg, nearly level with the middle of the tibia of irregular form, with transverse diameter, 24 mms. and longitudinal diameter 40 mms. The bottom of the ulcer was hollow, granulous and often bloody, with indentated sloping edges.

In this condition the patient consulted me; and I did not hesitate to recommend mild applications of massage and some appropriate active and passive kinesitherapic exercise, with a view to stimulate the veinous and lymphatic circulation in the limb. I thought it would also be good to add some applications of Roentgen rays to exert a direct influence towards the healing of the ulcer and to calm the pain.

The radiotherapy of varicose ulcers is now admitted by all the most eminent radiologists and dermatologists, and I myself had experienced in other cases its ready and indisputable efficacy.

The irradiation was localized only on the ulcerated cutaneous surface, all the healthy skin around it being protected by a localizer.

The apparatus I use for the production of Roentgen rays is one of the most perfect, and consists of the following:

(a) A Gaiffe transformer with closed magnetic circuit (without interrupter) working by means of the alternate monophasic street current, of 102 volts and 43 periods or cycles.

(b) Two Villard valvules interposed in shunt in the circuit, which separate the two alternating waves, letting only one pass into the tube, always in the same direction.

(c) A Becleie spintermeter inserted in the circuit to indicate the length of the spark gap and, through it, the degree of hardness of the tube.

(d) A special milliamperometer, to measure the intensity of the secondary current that traverses the tube, permitting us, in some degree, to control the emission of the tube itself.

(e) A Chabaud tube with Villard osmoregulator, specially adapted fo rradiotherapy , through the small quantity of rays it emits and through the ease with which the degree of hardness is maintained constant.

(f) A Benoist radiochronmometer, to estimate the degree of penetration of the rays emitted from the tube.

(g) A Labourade-Noire radiometer for the dosing of the quantity of X rays absorbed by the part treated in each sitting.

(h) A Belot localizer, of the latest design, to localize the Roentgen action upon the diseased part alone, and to protect those parts of the body, neighboring or remote, not to be irradiated.

With such a device there is no possibility of any error in the estimation, whether of the degree of penetration of the rays or of the quantity of rays in each sitting projected upon the part under treatment; and we have the absolute certainty that the Roentgen rays have acted only and exactly within the limits antecedently assigned to them.

Our patient then was subjected to radiotherapic sittings by the fractional dose method.

It is well known that there is a group of radiologists, especially French, with Beclere, at their head, who hold the dose in mass to be the best method.

To the part indicated they administer at once the largest dose of X rays recognized as compatible with the integrity of the cutaneous tissues and between one application and another, they leave a sufficient interval (a week) to prevent the accumulation of the successive doses.

But in the case before us, although there was no danger of injuring the skin, as it was already ulcerated, we had two reasons to prefer the fractional doses:

(1) The need of watching uninterruptedly the local and general reaction of the X-rays in so sensitive a patient, and daily to inspire her with confidence in the treatment, by means of a short sitting every day.

(2) The necessity of not exhausting a subject of little physical resistance by means of long and wearying sittings, and the desire to practice the sedative action of the X rays upon ulcerated tissues, at brief intervals.

The patient was comfortably extended on the radiotherapic bed; and to the ulcerated skin we applied the cylindrical tube of the Belot localizer, No. 2, of 40 mms. diameter.

In this way the ulcerated surface was exactly contained within the circumference of the localizing tube. as was also a small extent of its margins, in the longitudinal diameter; while the healthy skin included within the

localizer in the transverse direction was protected by a suitable plate of lead introduced under the localizing tube. The length of the localizing tube was such that the distance of the bottom of the ulcer from the centre of the anticathode of the Crookes' tube was exactly 15 cms. The Crookes' tube was every day regulated, so that its hardness should constantly correspond with 6 degrees Benoist. The quantity of rays administered at every application corresponded to 2 units H., and the sittings were made at intervals of three days. When a total quantity of 12-13 units H. was reached, there was a longer interval of rest.

Altogether 40 H. were administered in 58 days, which gives an average of about two-thirds H. each day.

Considering, however, that the final effect of a dose of X rays administered by fractions corresponds to the final effect of the dose in mass diminished by one-fourth (Belot), the total dose administered by us is reduced to an effective dose of 30 H., or to an average of one-half H. per day.

As is seen, it is a matter of very small doses, inferior to the average dose in ordinary use, not for ulcerated skin, but for whole tissues.

The treatment began on the 27th of February, 1906.

At the beginning the patient bore the treatment fairly well, and on March 13th, 1906, that is, after 15 days' treatment, having received in 5 applications a quantity of X rays corresponding to about 10 H., the ulcer was observed to be less deep, with its surface smoother, with less secretions, and with the edges on the way to healing. The dimensions of the ulcer were reduced by not a little, the longitudinal diameter measuring 36 mms., and the transverse 21 mms. The oedema of the leg was less pronounced, and the hard and deep-seated growths due to veinous and lymphatic varicosity were giving way under the action of gentle massage and the passive and active exercise of the extremities. The treatment then proceeded with full satisfaction, both to the doctor and the patient.

To avoid the possible too lively reactions at this point I ordered a longer interval of suspension of radiotherapy, continuing, however, the kinesitherapic treatment.

On March 20th the application of the Roentgen ray was recommenced, under the same conditions above described, the same does of X-rays being administered, and the same intervals of repose allowed.

On March 26th, after two applications of radiotherapy, in which about 4 H. were administered, the lady was seized with serious hysterical convulsions, which she had not had for a long time, and which were repeated for three consecutive nights, accompanied by an indescribable condition of nervous agitation. The radiotherapic treatment was suspended and she was treated as her nervous symptoms suggested. The ulcer was treated with oxide of zinc paste and with sedatives.

On March 30th, as the patient was restored, and we did not think there could be any relation between the radiotherapic applications and the nervous manifestations, the X-ray sittings were resumed; but the following night she had still more violent convulsions.

There was a new suspension of the radiotherapy, during which we observed that the local conditions of the ulcer were further improving.

On April 4th the radiotherapic applications were resumed, under the conditions before described, but from that day she complained of severe pains radiating from the ulcer and traversing her whole body, producing in her a condition of extreme agitation and hindering her sleep. As I had faith, however, in the success of my treatment, I continued the applications until the 14th of April, on which day the ulcer measured 18 mms. along the transverse diameter, and 35 along the longitudinal.

On April 29th the patient could no longer endure the burning and gnawing pain which extended from the ulcer all over the body, the nervous agitation that had mastered her, and the insomnia, and she definitely suspended the radiotherapy.

The nervous conditions of the patient became continually worse; there were almost continuous convulsions, and absolute sleeplessness, and the patient writhed piteously upon her bed.

They spoke of shutting her up in an asylum, for there was reason to fear for her sanity, but all at once, just this threat of confinement had a surprising and inspiring effect upon her, and the disquieting symptoms diminished gradually, and the patient could leave for her own town early in June, in moderate health.

Of the ulceration I have not been able to learn anything more, but it is probable it has continued healing.

The nervous phenomena from which our patient suffered appeared suddenly and without presumable cause other than the radiotherapic treatment. Further, these disturbances manifestly followed a course parallel with

the administration of the Roentgen rays, becoming weaker whenever the applications were suspended, and gradually assuming more serious proportion with the accumulation of the successive doses of X rays.

For these reasons we may consider that the cause of the disturbances of the central nervous system in our patient was the radiotherapic application. But at this point we ask ourselves: Was the radiotherapy in this case only an occasional cause or a true determining cause, the only and immediate beginning of the disturbances?

As we have already shown, various writers have proved that the Roentgen rays, applied directly to the spinal cord or to the brain of animals or man, produce indisputable functional and anatomical alterations, even without the cutaneous surface crossed by the rays being affected.

But all these authors have irradiated the nervous centres directly and the action obtained by them is reasonable and perfectly to be explained.

On the contrary, in our case the Roentgenian irradiation was directed upon a part very remote from the nervous centres and localized in a very small tract of the cutaneous surface.

How, then, could the action of the X rays make itself felt in the nervous centres, even as far as the brain?

Here we are met by an earlier hypothesis, based upon Kienbock's theory, according to which similar general disturbances of the organism, accompanied sometimes by fever, headache, delirium, etc., would be due to the absorption of toxin produced by the Roentgenian action upon the cellular elements of the ulceration.

But such an interpretation is not in this case admissible, because in our case there was no fever, and because the extension of the cutaneous lesion was so extremely limited as to render it improbable that it could produce the quantity of toxin necessary to occasion such serious phenomena.

Then, in our case, no other explanation remains except the following, namely: That the X rays, though acting locally upon the ulcer, also indirectly gave a stimulus—through the medium of the sensitive nerve terminations—that extended so far as the spinal marrow and the cerebral cortex, which already constituted the points of least resistance in a neuropathic individual.

So the action of the Roentgen rays was only an occasional cause producing the outbreak—by reflex action—of the nervous phenomena to which the patient was already predisposed by the constitutional weakness of her nervous centres.